New Approaches To Computer Games: Designers With A Difference

COMPUTE!'s GAZETTE

$2.95
December 1985
Issue 30, Vol. 3, No. 12
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FOR **COMMODORE** PERSONAL COMPUTER USERS

Soft Write Protector For Disks

Easily lock and unlock individual files—or entire disks—with these short programs for the 64, 128, Plus/4, 16, and VIC.

SpeedCheck: A *SpeedScript* Spelling Checker For The Commodore 64 and 128

You can add and delete your own words. Also compatible with *WordPro* and *PaperClip*.

The Construction Set

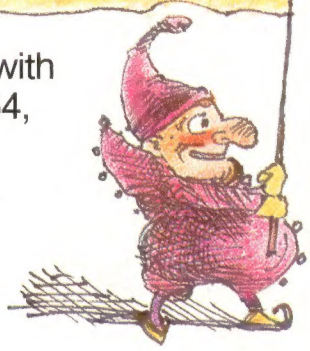
Create astonishing art with this exceptional program for the Commodore 64 and 128.

Also In This Issue:

Disk File Archiver
User Group Update
Horizons: The Talking Computer
And More

Banners

Create professional-looking signs with this easy-to-use program for the 64, 128, Plus/4, 16, VIC, and any Commodore or compatible printer.



Quickchange

Things happen fast in this novel game. Three strategy games in one for the Commodore 64 and 128.

All Commodore 64 programs in this issue work on the Commodore 128 in 64 mode.

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SOME HISTORIC BREAKTHROUGHS DON'T TAKE AS MUCH EXPLAINING AS COMPUSERVE.

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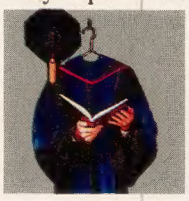

The College Board, operated by the College Entrance Examination Board, gives tips on preparing for the SAT, choosing a college and getting financial aid.

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Healthnet will never replace a real, live doctor—but it is an excellent and readily available source of health and medical information for the public.

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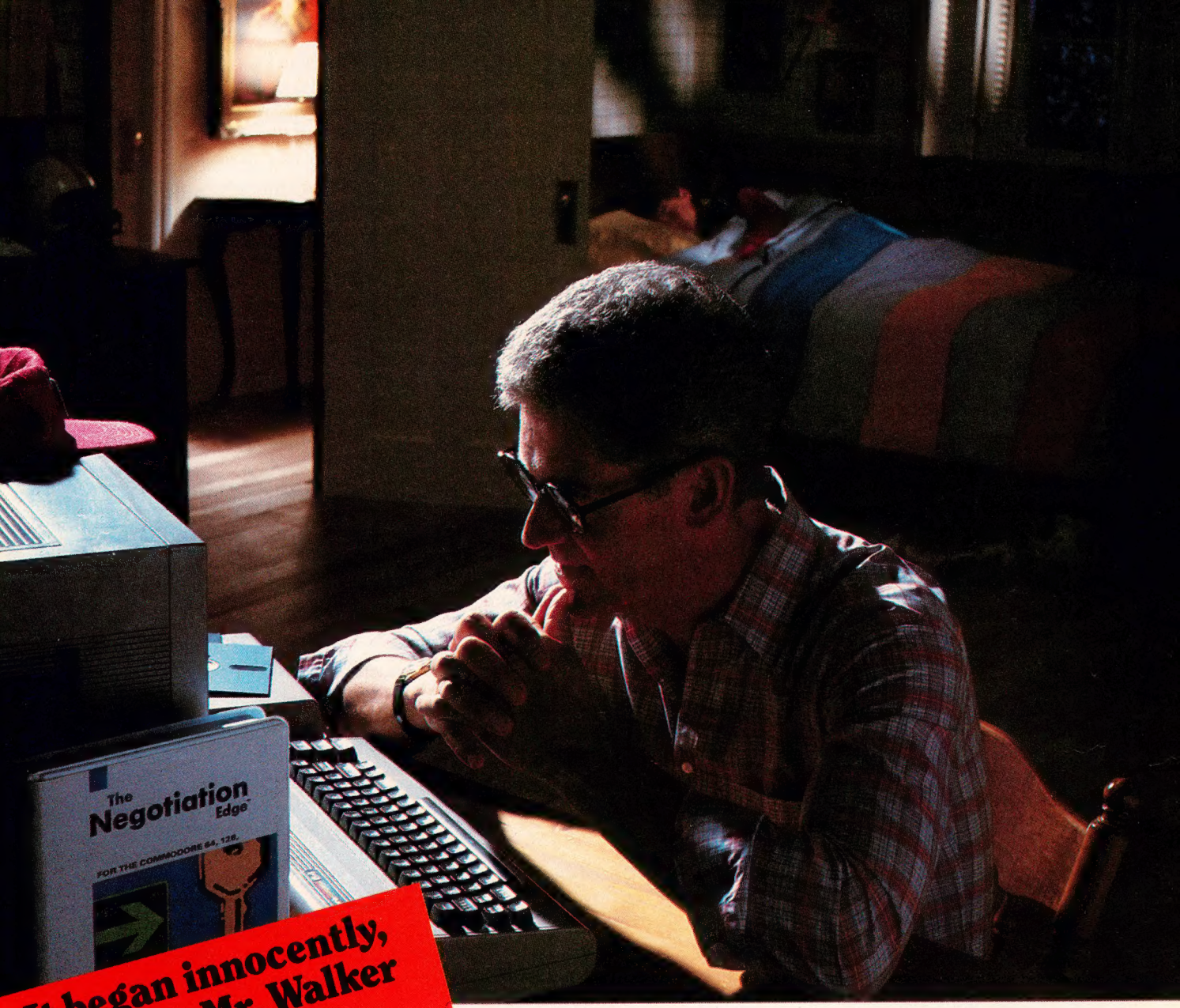

It began innocently, but soon Mr. Walker was running his entire career on little Bobby's Commodore.

Mr. Walker had never used a computer when he read about Info Designs' Negotiation Edge.™ He'd been meaning to ask for a raise and was looking for an "Edge."

That night, as Bobby slept, Mr. Walker's career turned. "Hey, Info Designs software makes Commodore® a terrific business computer."

The Edge line is people-insight software that's easy-to-use and only costs $79.95.*

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The ISS accounting modules are powerful, easy-to-use, and easy-to-learn. They include every business feature.

Mr. Walker was ecstatic with his new computerized business. And Bobby was happy because the monsters stayed in the closet while dad was in the room.

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Provides individually tailored strategy reports to improve customer relationships.

After the sales executive has completed the self-assessment and the customer-assessment, a sales strategy report is generated instructing the salesman in aspects of business style and personality most likely to strike responsive chords with the style of a given client.

The Negotiation Edge™

Designed to help the user prepare, develop, and successfully complete any negotiation or bargain.

On the basis of information provided by the user about himself and a specific counterpart, the program produces a detailed negotiation plan. The plan includes a step-by-step blueprint for winning negotiations in a variety of personal and business situations.

The Management Edge™

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Perpetual inventory records for all items include stock numbers, average cost, three retail prices, reservations, economic order quantity and re-order levels. Processes stock receipts, issues, orders and adjustments with full audit trails. Provides key management reports, including stock status, shortage and recommended re-order reports.

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A master record for each employee includes current period, quarter- and year-to-date pay activity. Automatically calculates period pay amounts, including miscellaneous pay and deductions, federal, state, and local taxes and FICA. Provides comprehensive reports, including W2s, 941s, payroll checks with full pay/deductions detail and payroll journals. (Interfaces with General Ledger for automated postings.)

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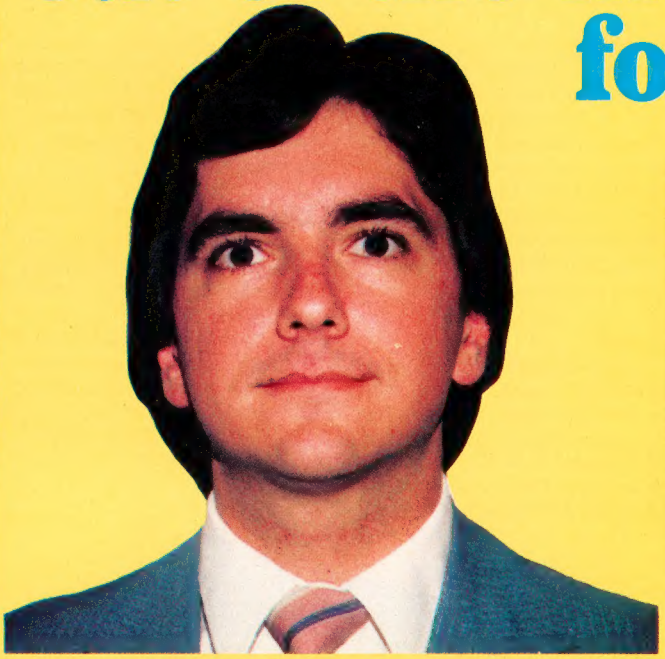
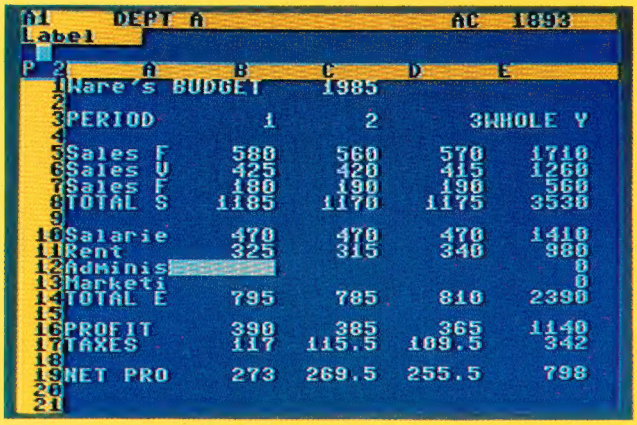
"Calc Result cut 10 years out of the mortgage time for my house",

says Tony Muscarella.





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Tony is a CPA, and works in Windsor Locks, CT. Tony bought his Calc Result two years ago. He was looking for a spread sheet program for the Commodore and found Calc Result.

"I think Calc Result is the best spread sheet on the market. It is very easy to use and logically built up. I have found the capacity I need in the program, and you can understand I have some demands, as I am an accountant. I did not believe that a homecomputer equipped with Calc Result could be so powerful.

I use the program for business as well as at home. The most frequent business use is loan amortization. With Calc Result it is a lot faster to see the status of a loan, and also how a change in the amortization will affect the payment time.

Calc Result showed me how a slight increase of 10—20 dollars per month on the house amortization could cut 10 years out of the amortization period for my house. Incredible!

Calc Result is a program that is very easy to use, and very powerful. I can really recommend it."

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† All Commodore 64 programs in this issue work on the Commodore 128 in 64 mode.

*=General, **V**=VIC-20, **64**=Commodore 64, **+4**=Plus/4, **16**=Commodore 16, **128**=Commodore 128

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editor's notes

Our Seasonal Cheer

Whither Amiga? At this October writing, we're anxiously awaiting the arrival of the first Amiga in our local store. *Anxiously* because the software's apparently coming in segments, what with the initial basic system due to ship in September, and the slow IBM-compatible software due to ship in October or November, and the faster IBM-compatible software due to ship by December, and, well, you get the picture. This introduction raises the spectre of Tramiels' past.

Enough of this snippy sniping though. We're really anxious because we're always anxious whenever Commodore is shipping a new product, or even preparing to ship a new product, or even announcing preparations to ship a new product. We, frankly, like Commodore products. Over the years Commodore has proven to be beneficial to the growth and competitive spirit in this industry. A series of quite successful Commodore machines has alternately upgraded, shaken, or sometimes helped drive this industry. Millions upon millions of us actively use Commodore computers. So it comes as no great shock that there might be a few delays on selected parts of the Amiga. And we're sure—rightly or wrongly—that we'll convince ourselves that they were worth waiting for because over the years of waiting for various bits and pieces of Commodore products we've always convinced ourselves.

Hopefully, by the time this reaches you, aisles will be full of cheerful, cherubic Amiga buyers, and, hopefully, those buyers plus all the thousands and thousands of you who are purchasing 128 systems will help Commodore have a happy and joyous quarter. Recent indications are that they need it. Our own early seasonal indications are that they might very well *have* a strong holiday sales season. On that positive note, we wish you all, our readers, and you, too, Commodore, a prosperous and exceptionally pleasant holiday and new year.

While we're tooting horns, we'd like to bring to your attention several significant new books from the editors at COMPUTE!. The two most directly relevant to you are *The Programmer's Guide to the 128* and *The Programmer's Guide to the Amiga*. The former is due out in December; the latter in January. As you know, we very rarely mention one of our own books in the editorial page, but this constitutes one of those exceptional cases. For the first time ever, we assembled a strong team of COMPUTE! staff editors and programmers and set them to work on developing a book from the ground up. We have never attempted a project with this approach before, and we expect you'll be quite pleased with our efforts. We've assembled an exceptional team here over the years, and are personally pleased when such a project develops the enthusiasm that this one has.

In this issue, you'll find "SpeedCheck," a spelling checker program that's compatible with *SpeedScript*, *WordPro*, and *PaperClip*, three of the best-known word processing programs for Commodore available today. The program can be easily customized to suit your writing needs. If you're a subscriber to the GAZETTE DISK, as a special bonus this issue, you'll find a 2,000-word dictionary included with this program.

Enjoy your GAZETTE.

Robert C. Lock

Editor In Chief

IF YOU CAN FIND A BETTER PROGRAM WE'LL BUY IT FOR YOU!*

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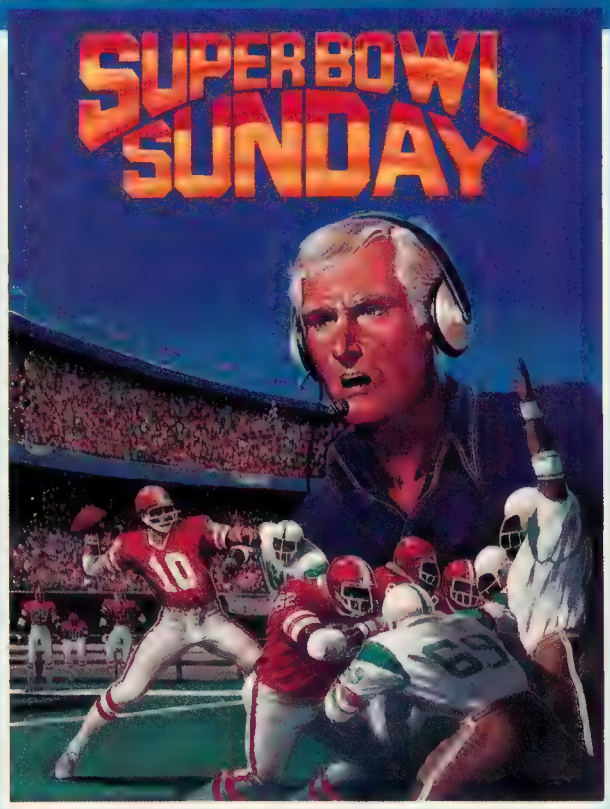

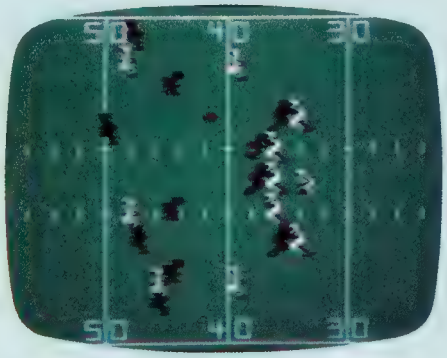

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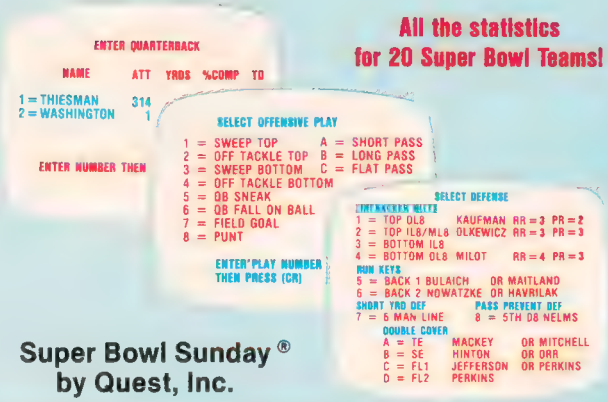
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6 = QB FALL ON BALL
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8 = PUNT
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C = FLAT PASS
SELECT DEFENSE
1 = TOP OLB KAUFMAN RR=3 PR=2
2 = TOP ILB/MLB OLKEWICZ RR=3 PR=3
3 = BOTTOM ILB
4 = BOTTOM OLB MILOT RR=4 PR=3
RUN KEYS
5 = BACK 1 BULAICH OR MAITLAND
6 = BACK 2 NOWATZKE OR HAVRILAK
SHORT YRD DEF
PASS PREVENT DEF
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Strings And Names Of Strings

Books say that the 64 recognizes only the first two letters of a string. However, if I run these two programs, the first says the strings are the same, while the second says they're different. Why?

```
10 A$="ABCD":B$="ABCD"
20 IF A$=B$ THEN PRINT "SAME"

10 A$="ABCD":B$ ="ABC"
20 IF A$<>B$ THEN PRINT "NOT THE
   SAME"
```

G. L. Short

There's a difference between a thing and the name of a thing. You might say plums are purple or "plums" is a five-letter word, but you'd never say "plums" is a five-letter purple word.

When a 64 or any other computer compares two variables with equals (=) or not equals (<>), it's not comparing the names of the variables—the variable name A$ is always a different name than B$—it's comparing the values held in the two variables. In the first program, the values are the same; in the second they're different.

The two character limit applies to variable names. *THIS$ and THAT$ might seem to be different variables with different names, but the computer keeps track of the first two letters only. So, as a variable name, THIS$ is equivalent to THAT$ because they both begin with the letters TH.*

Formatting New Disks

My disk drive works perfectly with commercial programs, but when I try to save a simple three line program of my own, I get the error message FILE NOT FOUND. What am I doing wrong?

Wayne Shaw

New disks are not ready for saving or loading programs. Before you can read or write to a disk, you have to format it with the NEW command. Put the disk in the drive and enter this line:

OPEN 15,8,15,"N0:*diskname,id*"

or

```
OPEN 15,8,15
PRINT#15,"N0:diskname,id"
```

Make up a name for the disk, up to 16 characters long. The two-character ID should always be different than the IDs you give to other disks. As the disk is formatted, you may hear some knocking sounds, and the red light will turn on. Type **CLOSE 15** *and the light will eventually go out. Once the disk is formatted, it stays formatted, so you only need to do this once.*

Formatting erases everything from the disk, so don't use this command on commercial software (besides, the disks are already formatted). You can quickly reformat a formatted disk by leaving off the ID, but remember that everything will be erased.

Crunching Vs. Readability

When I program, I usually allot one command per line. When I list it, I can easily follow the program. Why are the programs in COMPUTE!'s GAZETTE crunched down? When a line contains several commands, it's much harder to read.

Stephen Paylor

Back when the VIC-20 first appeared, with its limited 3.5K of memory, one of the main reasons for crunching was to save memory. Each program line takes up five bytes for overhead, so combining six commands on one line saves a couple dozen bytes of memory. Old habits are hard to break; many VIC owners who upgraded to a 64 still put several statements on a single line. Crunched programs also run slightly faster.

Another advantage to crunching is that it allows you to see more of the program at the same time. A subroutine with 50 statements wouldn't fit on the screen if you only had one command per line. Combining lines saves some time, because you don't have to keep typing LIST. And when you list to a printer, a crunched program uses less paper.

In some cases crunching is the best way to handle an IF-THEN statement. Consider the following line:

590 IF A=15 THEN B$="DISK": TV=1

When the condition is not *true (A is not 15), the computer proceeds to the next line; it does not continue to the next command on the same line. In this case, if A equals 15, then two variables are assigned new values. By adding a colon and additional statements, you can make several things happen after an IF-THEN.*

Another important consideration from our point of view as publishers is magazine space. If we used one statement per program line, the listings would consume much more space in the magazine—which translates to fewer programs and articles.

The drawback, as you've noted, is that crunched programs are less readable. There are several reasons for crunching, but if readability is important to you, single-statement lines would be best when writing your own programs.

Scanning The Keyboard

Can you suggest a BASIC routine which would allow the computer to scan the keyboard for a specific key to be pressed? I know you can use a line like **10 GET A$: IF A$="" THEN 10**, but what if you want the program to continue running until a key is pressed? I know you could do it in machine language, but is it possible in BASIC?

Larry D. Dodgens

Commodore computers automatically scan the keyboard 60 times a second. If a key is pressed, its ASCII value is put into the keyboard buffer. GET takes a character out of the buffer; if no key has been pressed, GET will hold a null string.

You don't need to write a program to check the keyboard; the computer already takes care of it. This short program demonstrates:

```
10 GET A$: IF A$="A" THEN 30
20 PRINT "THE PROGRAM CONTIN-
   UES": GOTO 10
30 PRINT "THE A WAS PRESSED":END
```

In line 10, the character in A$ is a null string (zero characters long) as long as no key has been pressed, and the program continues in the simple loop until you press the letter A.

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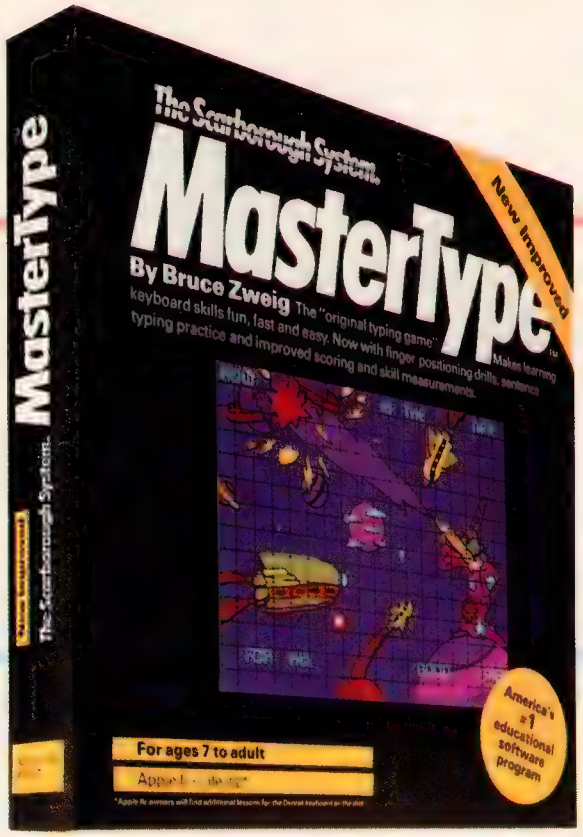
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Another way to do the same thing on a VIC or 64 is to use **PEEK(197)** *or* **PEEK(203)**, *which will hold a value of 64 if no key is being pressed. If a key is pressed, these memory locations will contain a number from 0–63, depending on the keyboard matrix (row and column of the key on the keyboard). These locations don't read CTRL, SHIFT, RESTORE, or the Commodore key.*

Can Function Keys Be Programmed?

Are the function keys unique in any respect? Is there a function they can be used for?

Curtis R. Finke

The newer Commodore computers—the 128, Plus/4, and 16—have programmable function keys. You can enter a line like **KEY7, "LIST-100:" + CHR$(13)** *to define f7. Thereafter, every time you press f7, "LIST-100:" will be printed, and the program lines through 100 will list. Assigning frequently used commands to the function keys can save time when you're programming.*

On the VIC and 64, the function keys cannot be defined in BASIC, although some programmer's utilities add such a feature. On these two computers, the function keys have the following ASCII values:

f1	*133*	*f2*	*137*
f3	*134*	*f4*	*138*
f5	*135*	*f6*	*139*
f7	*136*	*f8*	*140*

Note that they're not in numeric order. The first four are unshifted (odd numbers); the second four are shifted (even). You can have a program check to see if a function key has been pressed with a routine like this:

```
520 PRINT "PRESS F1 TO PLAY
    AGAIN, F2 TO END"
530 GET K$: IF K$="" THEN 530
540 IF K$=CHR$(133) GOTO 30
550 IF K$=CHR$(137) THEN END
```

As a substitute for CHR$(133), you can type a quotation mark, the f1 key, and another quotation mark. The function keys normally don't correspond to printable characters. But when the computer is in quote mode, pressing a function key returns a reverse character.

Restarting A Program

I cannot figure out how or when to use the CONT statement.

Andrew Gnoy

The CONTinue statement causes a program to start up again after it's been stopped. You might call it a close relative of RUN and GOTO.

When you run a BASIC program, all variables are cleared and the computer starts working at the lowest numbered line in the program. You can add a line number if you wish, RUN 200 for example, to skip over the first part of the program. Either way, all variables are erased.

GOTO is most often used inside a program to change the program flow. But it can also be used in direct mode to start up a program. GOTO does not affect variable values, which makes it valuable in testing a routine. You define some variables and then GOTO the beginning of the routine, to see if it's working correctly.

Like RUN and GOTO, CONT causes a program to run. But it always restarts a program that has been stopped for some reason; you never start up a program for the first time with CONT.

In BASIC, STOP and END can make a program stop running. Pressing the STOP key does the same. While the program is stopped, you can print out variable values or LIST a line to find out what's going on inside the program. The technique of stopping a program and then CONTinuing it is most often used in debugging.

You can't use CONT if an error has stopped the program. And if you change a line (or even just press RETURN over a line), variables are cleared and CONT won't work. The 128 presents an exception to these rules: Variables are kept in a separate bank of memory, so entering a line doesn't clear them. And the 128 has a RESUME command that allows you to continue after an error has occurred.

Stymied By Error Messages

Could you please help me with these error messages?

```
UNDEF'D STATEMENT
OUT OF MEMORY
NEXT WITHOUT FOR
BAD SUBSCRIPT
ILLEGAL QUANTITY
```

I retyped all the lines that had an error and they still came up with the same messages.

Kim Spain

When the computer says there's an error, the line number listed is not necessarily the one causing the problem. For example, **1010 GOTO 1125** *should send the program to line 1125. But if you've forgotten to include a line 1125, the program can't go there; it stays at line 1010 and prints "UNDEF'D STATEMENT ERROR IN 1010." Line 1010 is typed correctly; the problem is that line 1125 is missing.*

NEXT WITHOUT FOR means there's a mistake in the logical flow of the program. A FOR-NEXT loop needs a FOR at the beginning and a NEXT at the end. A NEXT by itself doesn't make sense—the program can't finish a loop that hasn't begun. If you're typing in a program from a magazine or book, check back a few lines to find the FOR that starts the loop.

If you're writing your own program, check to see that the loops are nested properly. When you put one loop inside another, the FOR and the NEXT of the inner loop have to be completely within the bounds of the outer loop. In other words, the first nested loop to begin has to be the last to end.

OUT OF MEMORY sometimes happens when you don't have enough memory for the program and variables, especially if you're working with an unexpanded VIC or trying to write a long hires graphics program on a Commodore 16. But most often it's a result of jumping out of a FOR-NEXT loop or exiting a subroutine with a GOTO rather than a RETURN. (See "Don't Jump out of Loops" in the September 1985 Gazette Feedback for more about this error.)

The next error, BAD SUBSCRIPT, means there are problems with an array variable like A(5), BR(J), T$(15), or A4%(Z)—a variable name followed by a number or expression in parentheses. An array should be dimensioned with the DIM statement before you use it for the first time. **DIM A(24)** *makes the computer establish an array called A that has 25 elements, numbered 0–24. An array is like a numbered list of variables.*

If you use DIM A(24) and then try to read or write a value with A(30), the subscript—the number in parentheses—is too large and you'll get the error message. It could also occur if you accidentally assign the value 600 to variable J and then try to do something with A(J). When J is equal to 600, A(J) is the same as A(600), which is a bad subscript (unless you've dimensioned the array to a size of 600 or greater). When this error happens, check for a missing DIM or a subscript that's too large. If you don't dimension an array, it defaults to 11 elements numbered 0–10.

There are several situations that can cause an ILLEGAL QUANTITY error. Generally, this results if you're trying to place a number that's too large or too small in a function or command. For example, there's no such thing as the logarithm of zero, so **PRINT LOG(0)** *yields this error message.*

One of the most common causes of an ILLEGAL QUANTITY error is trying to POKE a number larger than 255 into memory. Say you forgot to type a comma in a list of DATA statements:

```
10 FOR J=49152 TO 50000: READA:
   POKEJ,A: NEXT
513 DATA 169,10,133 16,255,13
```

It's legal to have numbers of any size in DATA statements, but POKEs to memory have to be in the range 0–255. In this case, line 10 reads the third number as 13316, which is much too large to be

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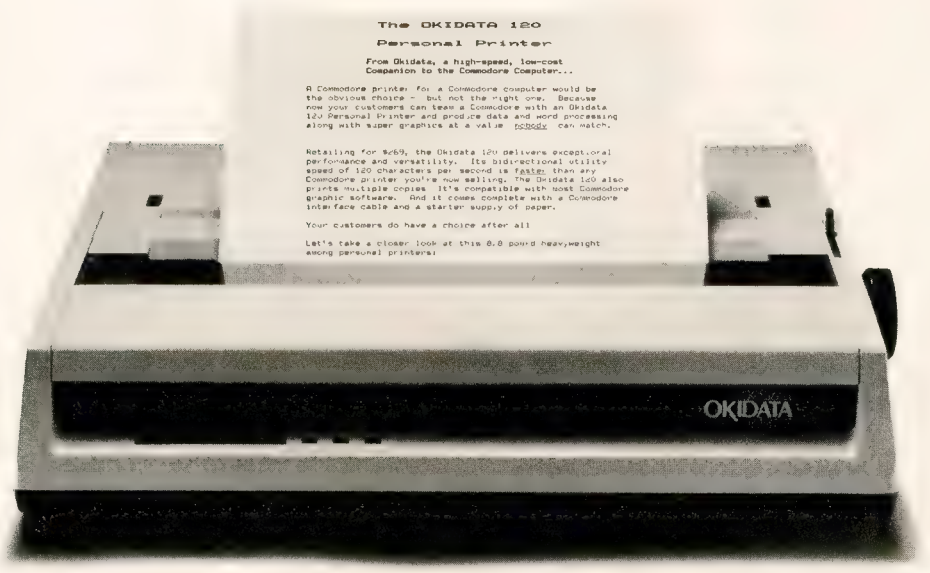
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POKEd into memory. The READ works fine, it's the POKE that fails. The error message reports that line 10 is wrong, even though 513 has the missing comma.

When the computer reports an illegal quantity, list the line. If there's a READ followed by a POKE in the line, type **PRINT PEEK(63) + 256 * PEEK(64)** *to find out which line of DATA contains the problem.*

No VIC Support?

I just inherited a VIC-20 with a Datassette and 16K expander. I found out that Commodore has discontinued the VIC, and I can't find any software at all. Can you help?

Steve Zabuska

You'll have to look very hard to find software for the VIC. Commodore stopped producing VIC software last year, as did almost all third-party publishers. Some mail-order companies still have VIC software at closeout prices.

We can suggest two other sources that can help. Various Commodore user groups have VIC enthusiasts, and some of these groups have a sizable library of VIC public domain programs. The second source is COMPUTE!'s GAZETTE, *which has published software for the VIC since the first issue, in July 1983, and continues to do so. Although we've reduced our VIC coverage to provide more coverage of the newer Commodore machines, there are hundreds of type-in programs in past issues, many of which are still available. And the* GAZETTE DISK, *started in May 1984, has included many ready-to-run VIC programs in each of its issues. All back issues of the* GAZETTE DISK *are available.*

Relative Files

In the June article on relative files, you say to add 96 to the channel number when the pointer is positioned. Why is this done?

Peter Rushie

Earlier editions of the 1541 User's Manual *used the channel number by itself, while newer manuals say you should add 96. We called Commodore and one of their technical staff said that Commodore programmers have found that adding 96 makes relative files work more reliably. Our experience is that relative files work with or without the 96. But since Commodore recommends the 96, it's probably a good idea to use it.*

On another note, several readers have asked if disk validation destroys relative files. The answer is no, validation won't harm relative files. The validate command takes relative files into account when it cleans up the block allocation map.

Typewriter Emulation

I am having problems writing a "typewriter" program. I'd like to press a key and have it print on the printer. But the printer moves to the next line after every letter. Can you help?

Gary Thomas

Your program probably looks something like this:

```
10 OPEN 4,4,7
20 GET A$: IFA$=""THEN 20
30 PRINT#4,A$:GOTO20
```

Both PRINT and PRINT# add a carriage return, which is why you're seeing only one character per line. You could add a semicolon between A$ and the colon in line 30, but that would lead to another problem. Printers generally save characters sent to them in a buffer until they receive a carriage return. You would be typing blindly until you pressed RETURN (which would make the letters print all at once). Try changing line 20:

```
20 INPUT A$
```

As you type, you'll see the letters on the screen. Pressing RETURN causes the line to print. The letters don't print one by one, so it's not quite a typewriter, but it's a workable solution.

Hexadecimal Conversions

Is there an easy way to convert decimal numbers into hex? I have looked at several books about this, but don't understand how to do it.

Evan Unsell

Another name for decimal, the numbering system we use, is base ten. *Decimal numbers include only the ten digits 0–9. For larger numbers, the digits are multiplied by powers of 10 (10, 100, 1000, and so on). The number 365 expands out to (3×100) + (6×10) + (5), for example.*

Hexadecimal, base 16, is often used to represent quantities in machine language programs, for the sake of convenience. The sixteen digits are 0–F. The numbers 0–9 are followed by A–F (there isn't a single digit for the decimal value 10, so in hex, A is worth 10, B is 11, up to F, which is 15). Numbers larger than 15 (hex F) are multiplied by powers of 16 (decimal 16, 256, 4096, and 65536). A dollar sign ($) is commonly used to mark hex numbers. The number $2A7 is decimal 679: (2×256) + (10×16) + (7) = 679.

Here's a short conversion routine for translating decimal to hex. It works on all Commodore computers (although on the 128 and Plus/4, it's easier to use BASIC's DEC(X) and HEX$(X) functions).

```
10 HX$=""
20 INPUT"DECIMAL";D
30 T=((D/16)-INT(D/16))*16:HX$
   =CHR$(T+48-(T>9)*7)+HX$:D=(
   D-T)/16:IFDTHEN30
40 PRINT"HEX: ";HX$:GOTO10
```

To go the other way, from hex to decimal, use these lines:

```
10 D=0
20 INPUT"HEX";HX$
30 FORJ=1TOLEN(HX$):M$=MID$(HX
   $,J,1):D=D*16+ASC(M$)-48+(M
   $>="A")*7:NEXT
40 PRINT"DECIMAL: ";D:GOTO10
```

Neither routine has any error-checking. Make sure you enter only positive numbers in the first program. And input in the second program should be limited to numbers 0–9 and letters A–F.

Scrambling A List

How can a selection of, say, ten random numbers be printed to the screen or printer without repeating a number in the selected range? The RND command sometimes repeats a number.

John G. Walker

The random number function RND wouldn't be random if it didn't repeat occasionally.

Consider a random event like flipping a coin. You have a 50/50 chance of seeing heads or tails. But if the first toss is heads, that doesn't mean the second toss has to be tails. The second time the coin is flipped, it again has a 50/50 chance of being heads or tails. So it's possible for a coin to be heads any number of times in a row. The same goes for dice or other random number generators. There's always a chance of repeating.

Now think about shuffling cards. If the first card drawn is a three of diamonds, you know the second card can't possibly be a three of diamonds. This method of randomizing doesn't repeat like coins or dice would. One answer, then, is to create a list of numbers and shuffle them around randomly, like a deck of cards. The following program creates an array of 20 numbers (initially in order) and trades the numbers around. It then prints the first five. This general shuffling routine could be modified for card games, bingo, or even picking a lottery number.

```
10 DIM A%(20): R=RND(-TI/101)
20 FOR J=1 TO 20: A%(J)=J: NEXT
30 FOR J=1 TO 5: FOR K=1 TO 20:
   L=A%(INT(RND(1)*20+1))
40 TEMP=A%(K): A%(K)=A%(L):
   A%(L)=TEMP
50 NEXT K,J
60 FOR J=1 TO 5:PRINT A%(J):NEXT
```

A One-Way Street

Could I use the video out jack on my VCR to send a screen or other information to my 64?

Steve Schindler

With the right cable, you can record the video signal from your 64 on a VCR. But it's a one-way connection: You can't send signals from a videotape to a 64 without a

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special kind of interface called a digitizer.

A computer is digital; it works in ones and zeros. There are no in-between states: Bits in memory can't be 1/2 or 3/4 on. TVs and VCRs, on the other hand, work with analog signals. To translate digital memory to analog TV, a 64 contains a radio frequency (RF) modulator, which is basically a miniature low-power television station that outputs a TV-compatible signal. Since the output works with televisions, it can be diverted to a VCR to be recorded. You could create title screens for a home videotape, for example.

A digitizer works the other way. It takes an analog signal and converts it to the ones and zeros used by the computer. See the June "Horizons" column for a review of a product that creates hi-res pictures from TV input, using the signal from a camera or videotape.

Moving ML Programs In Memory

"Screen-40" from the June GAZETTE was a welcome addition to my collection of VIC programs. However, it does consume about 7K of available BASIC memory. With full memory expansion and a machine language monitor, I tried to move it out of BASIC into block 5. But the VIC locks up. Do you have any suggestions?

Delmer Wohlgemuth

Two barriers must be overcome before you can move the program up to block 5. Unfortunately, one of the barriers is insurmountable.

The first barrier is the way machine language (ML) handles jumps. The instructions JMP and JSR are similar to BASIC's GOTO and GOSUB. They're followed by a two-byte address. If an ML program contains any JMPs or JSRs, you can't relocate it to another section of memory without also changing the addresses of the jumps. It would be like renumbering a BASIC program without changing the line numbers after the GOTOs and GOSUBs. In addition, there may be load or store instructions that use memory within the program area. They too would have to be modified.

Even if you successfully alter the program and put it up in block 5, there's a hardware limitation that will prevent Screen-40 from working. The program simulates 40 columns via a high-resolution screen. Since the VIC does not have a true hi-res mode, hi-res is simulated with double height custom characters. And the video chip only allows you to put custom characters into memory at 4096–8192. So approximately 4K would have to remain where it is.

It's possible to rewrite the ML part of the program to move it higher in memory, but the hi-res part would have to stay where it is (between 4096 and 8192).

Sprites Can Interfere With Files

I've run into a puzzling situation recently. I'm writing a 64 program that uses relative files and sprites. On an entirely random basis, the program would lock up. The solution was to turn off the sprites while accessing the relative file, then turning them back on after the file was retrieved. Why would sprites interfere with reading disk files?

Dennis Smith

Sprites can cause difficulties with disk and tape access. Always turn sprites off before reading or writing files.

Here's why: The 6510 chip, the "brain" of a 64, reads instructions and information from memory and takes care of the math and storing to memory. At regular intervals, an interrupt from the VIC-II chip stops the 6510 temporarily, so screen and color memory can be converted into video signals to be sent to a television or monitor.

When sprites are turned on, the VIC-II has to work harder, to determine X and Y positions, colors, priorities, and shapes. It also checks for collisions. The extra activity by the video chip apparently steals time from the 6510 and seems to throw off the timing for accessing files.

Software Speech

Is there a way to make a 64 "talk" without a speech synthesizer? I'm writing a game and want to have speech in it.

Billy McNaughton

There are two approaches to making a computer speak: speech synthesis, *where individual sounds are combined to create words, and* speech digitization, *where words or phrases spoken into a microphone are converted into patterns that can be stored in memory.*

Speech synthesizer cartridges usually contain a computer chip which is programmed to produce phonemes, the individual vowel and consonant sounds that make up words. Phoneme-based speech synthesizers have an unlimited vocabulary because they can string together any number of phonemes to produce any word in the language.

Other speech cartridges are word-based. They are programmed to pronounce perhaps 200 commonly used words and that's all. Word-based speech modules tend to produce more recognizable speech because the words have been digitized from actual spoken words, although the size of the vocabulary is limited.

Many readers have asked how the voices in games like Ghostbusters, Impossible Mission, Beach-Head II, International Hockey, and Kennedy Approach *were created. These and other programs use digitized speech. Each program has a small number of words and phrases it can play back. You don't need any special hardware to listen to the voices, but a digitizer and a microphone are necessary to convert the sounds to a digital format that can be used by the computer.*

You need extra hardware to digitize speech, but phoneme-based speech synthesis through software is also possible on the 64 because the SID chip can produce such a wide variety of sounds. There was once a commercial program for the Atari and 64 that synthesized speech in software, but the company that made it has apparently gone out of business. At present, we know of no software speech synthesizers that are available.

Passing Variables In Chained Programs

I'm writing a program that has to load a second program. The problem is that I need to keep the variable values from the first program. How do I do that?

Steve Blum

If the first program is longer than the second and you're working with numeric variables only, you'll have no problems. Just add the LOAD command at the appropriate place in the first program. The second program will load and automatically run.

String variables will be kept intact if they're dynamic strings, but they'll be lost if they're static. The following lines illustrate the difference:

```
10 A$="PRESS ANY KEY"
20 READ B$
30 C$="PRESS"+" ANY KEY"
```

The string variables in lines 10 and 20 are static. In the first case, the computer saves memory by setting up A$ with a pointer to the BASIC line where it was defined. In line 20, READ assigns a value to B$ and the computer creates a pointer to the appropriate DATA statement. When a new program is loaded, the pointers to both of these variables will point to a place inside the new program, with incorrect results. Line 30 creates a dynamic string by concatenating two strings via the plus sign. Since the new variable is a combination of two separate strings, the computer has to store it in variable memory. You'll find that C$ is intact when the second program is loaded. To force variables into being dynamic, add a null string (two quote marks with nothing inside) to each:

```
10 A$="PRESS ANY KEY"+""
20 READ B$: B$=B$+""
```

Loading a long program from a short one leads to disaster because the pointer to the beginning of variables is not updated when you load from within a program. You can avoid problems by following these steps:

First, load the final version of the

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*longest of the chained programs. Don't run it. If you don't know which of the programs is longest, check the pointer to beginning of variables—***PRINT PEEK(45), PEEK(46)**. *The longest program will have the highest number in 46. If two are the same, pick the one with the highest number in 45. Write down the values in 45 and 46.*

Now load the first program you'll be running. Let's say the longest program had the numbers 113 and 20 in the pointer at 45–46. Add this line as the first line in the first of the chained programs:

1 IF AL=0 THEN POKE 45,113: POKE 46,20: CLR: AL=1

The values 113 and 20 are for illustration only; you should substitute whatever values you got from PEEKing 45–46 from the largest program. Since the pointer now matches the longest program, you can chain the programs. If you make any changes to the programs, you may have to go back to the first program and change the numbers for the POKEs in the line above.

Saving A Subroutine

Is there a way to load a program and then save just part of it, like the last few lines or a subroutine?

C. E. Spurlock

It depends on the length of the subroutine. If the listed lines fit within a single screen, try this shortcut. First, LIST them—if the lines are numbered 12010–12120, enter **LIST 12010-12120**. *Now type NEW, which erases the program in memory. The program may be erased, but the screen isn't. Next, position the cursor on the first line of the subroutine. Press RETURN over each line you want to keep. Since the lines have been put back into memory, you can save them to tape or disk.*

If the lines you want to keep exceed a single screen, you'll have to delete the lines you don't want. The easiest way to erase part of a program is to use a utility like "BASIC Aid" or "MetaBASIC," although there are roundabout methods for doing it directly through BASIC.

Saving Plus/4 Data On Tape

Commodore has said that saving word processing and spreadsheet data to tape (from the Plus/4's built-in software) is not possible. But I've discovered a method to do so:

1. Enter the spreadsheet or word processor by pressing the f1 key and RETURN.

2. Enter whatever information you plan to save.

3. Hold down the RUN/STOP key and press the RESET button on the side. Be sure to keep RUN/STOP down until you've released the RESET button. You're now in the machine language monitor.

4. Type **S "filename",1,4000,D000** and then press RECORD and PLAY on the Datasette. The save takes about 18 minutes.

To reload, go into the spreadsheet or word processor, press RUN/STOP–RESET, and enter **L "filename",1**. After the data is loaded, type X and RETURN twice.

Les Tuttle

Thanks for the tip. The monitor SAVE command you listed saves 36K of memory, from $4000–$D000, which is why it takes so long to complete the process. You may not have to save that much memory if you can find a pointer to the beginning and end of data. Perhaps other readers with a Plus/4 can help. You might also write to:

The Plus/4 Users' Group
Box 1001
Monterey, CA 93940

They publish a newsletter with information about the Plus/4, including reviews of commercial software. They also have a library of public domain programs for the Plus/4.

Can You Read The RESTORE Key?

I would like to know how to read the RESTORE key to see if it has been pressed.

Douglas Hoch

RESTORE is unlike any other key on the VIC or 64. The regular keys are scanned 60 times a second to see if the user has typed something. That might seem very fast until you consider that the computer's internal clock chip is zipping along at approximately one megahertz, one million ticks per second. A sixtieth of a second is a long time to a processor that works in millionths of a second.

RESTORE is wired directly to one of the 64's Complex Interface Adapter (CIA) chips. When you tap RESTORE, the CIA chip generates a nonmaskable interrupt (NMI) that happens immediately—the processor doesn't wait for the next 1/60 second to pass. The computer looks at a pointer at 792–793 and goes to a routine that does two things. It checks for a cartridge and tests the STOP key. If a cartridge is not installed and the STOP key is not pressed, the VIC or 64 goes back to the main program. Otherwise, it either follows instructions from the cartridge (if one is plugged in) or stops the program and continues with the RUN/STOP–RESTORE sequence.

So you can't PEEK the RESTORE key from BASIC. It isn't one of the normal keys. The only way to read it is to write your own machine language routine and wedge it into the vector at 792–793.

Rotates And Shifts

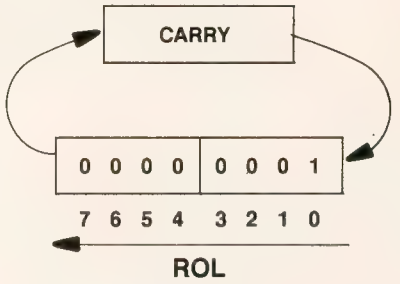
I have tested this short program with three different monitors. When it reaches the BReaK at $2008, the monitors display the contents of the registers.

```
2000 A2 04    LDX #$04
2002 A9 01    LDA #$01
2004 2A       ROL
2005 CA       DEX
2006 D0 FC    BNE $2004
2008 00       BRK
```

Most of the time, the Accumulator shows the correct value of $10, but sometimes it is something else. Also, when the first line is changed to LDX #$08, the Accumulator is almost always $80 when it should be $01. Is this a problem with hardware or software, or is it a bug in the 64?

Paul Wyles

If you look at how ROL works, you'll understand the problem in your program. Here's a diagram of what the ROtate Left instruction does:



The LDA #$01 instruction puts the number 1 into the accumulator, as the diagram above indicates. The LDX-DEX-BNE instructions create a loop that runs four times. So the rotate left (ROL) instruction executes four times, moving the 1 in bit 0 over four spaces to bit 4. So far, so good.

But every ROL also moves whatever is in the Carry flag into bit zero of the accumulator. If the Carry is clear at the beginning of the loop, the result is binary 00001000 (decimal 8). But if the Carry is set, four rotates, plus the carry, turn into binary 00001100 (decimal 12). The extra 1 in bit 2 is the Carry flag.

To solve the problem, you have two choices. Either add a CLC (CLear Carry) instruction before the loop begins, or use ASL (Arithmetic Shift Left) instead of ROL. ASL works almost the same as ROL. They both transfer bit 7 into the Carry flag. But ASL always moves a 0 into the rightmost bit, regardless of whether or not the Carry flag was set.

The answer to your second question is that it takes nine rotates, not eight, to get back the number you started with. Eight ROLs put the contents of bit 0 (a 1 in this case) into the Carry. The next eight ROLs move the 1, still in the Carry flag, eight positions left to bit 7. That's why you usually got an $80 in the accumulator.

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Designers With New Approaches To

Kathy Yakal, Assistant Features Editor

The majority of videogames have one primary goal: *Beat the opponent*, whether it's the computer or another player. But some software designers emphasize other aspects of the game, challenging players to succeed by interacting with each other and with the game's environment.

If this industry is going to grow up, says software designer John O'Neill, then we've got to be appealing to people who don't even consider using a computer.

And any good designer knows that the best way to get someone deeply into a game is to create an environment that begs to be explored, continues designer Tom Snyder.

Not that all games should be deep, meaningful experiences. We all need light entertainment sometimes. But quite often, a good book or movie gives us insights into ourselves and our world while entertaining us at the same time. Computer software can also do that, and many software designers are turning to that kind of experience. Some of the best have been at it all along.

Long before there were computer games, or home computers for that matter, John O'Neill was formulating a philosophy that would eventually figure prominently in his current role as a game designer. O'Neill, who grew up in England, began painting as a youngster, and went on to study art in college. In his early twenties, he started experimenting with different forms of interactive art and music.

He discovered something very important when he exhibited some of his works at a one-man show in London at the age of 23. "The show felt all wrong," says O'Neill. "I felt the people out in the street should be in there, and the people in the gallery were only there because they were friends of mine, friends of the art world, or friends of the gallery. And the galleries were basically just serving the investment world."

His idealism about the way things should be was such that he said, *That's it. I'm going to retire for ten years and come up with a totally new art form, a way for artists to work with people.*

So he explored different philosophies, and eventually came to believe that the only way to create consumer products that would appeal to peoples' inner sensitivities was to work through consumerism, through mass publication and broadcasting.

He formed a company called Admacadium, a half-Latin, half-English word that means *creative catalyst.* The company's purpose was to produce art for the masses. There would be no limited editions of works to impose value, and products would be priced affordably.

"I had a lot of catastrophes," says O'Neill of those early years. He made postcards, board games, decals, cards, little books—anything that might bring *accessible* artistic pleasure to people.

He began lecturing on his theories in art schools. ("I was hated by most traditional artists and very popular with students.") He finally spoke at Stanford with David Thornburg, who told him he had envisioned the computer games of the future, that all he was missing in his material was the computer.

So O'Neill left his native England for Silicon Valley. He worked

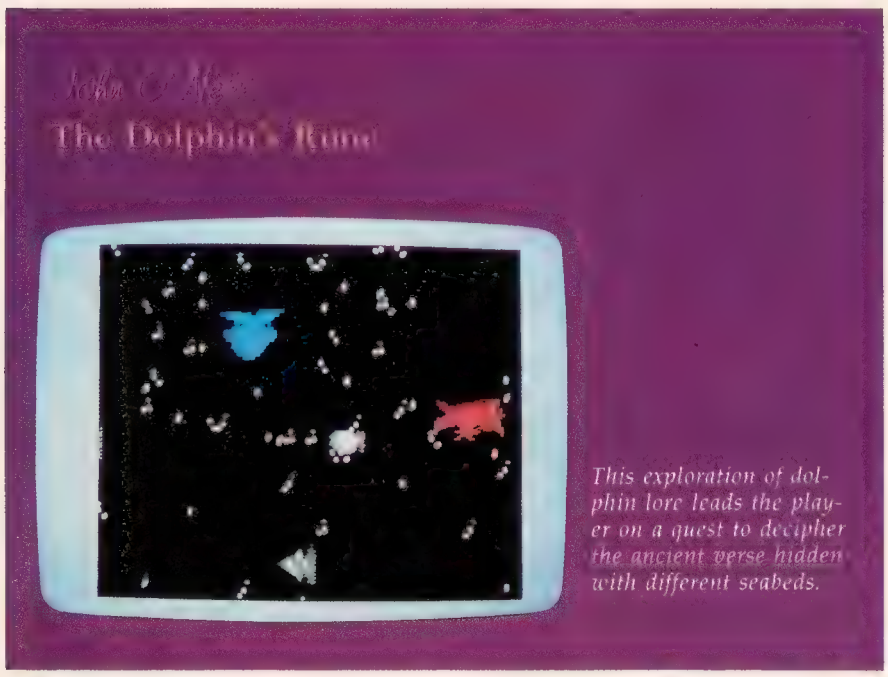
A Difference

Computer Games

as a game designer with Ramone Zamora at Childware for a while, and designed the graphics for Atari's *E.T.* game. For the last couple of years, he has been working with a team of designers in the Bay area, producing a series of interactive videogames.

One of the first to be available is *The Dolphin's Rune*, published by Mindscape. The game combines visually pleasing images with intellectual challenge. O'Neill consulted Dr. John Lilly, a dolphin research specialist, in developing the program.

In *The Dolphin's Rune*, the player assumes the role of a dolphin searching for a nine-stanza poem. The dolphin must locate and negotiate nine different color currents to search for runes. Each rune is part of a special alphabet which unlocks one of the verses, a key to dolphin lore. Along the way, the dolphin must avoid traps like tuna nets, and remember to come up for air every eight minutes.



This exploration of dolphin lore leads the player on a quest to decipher the ancient verse hidden with different seabeds.

O'Neill often uses symbols in his games to represent the search for self-understanding. Sometimes the symbols are obvious. Other times, you may play a game several times before realizing what O'Neill is gently trying to get at.

"I try to put in as many cliches as possible so one can begin to see the cliches in one's life," says O'Neill. "In *Lifespan* (another O'Neill game), you actually *dive* into opportunities, and you can't go back for a missed opportunity. All of these sorts of things will be left in peoples' minds. After the playing of a game, they will begin to see the cliches which they use a lot but have forgotten the meaning of.

"If you give people this kind of chance to interact with themselves, they can be put in the position of looking over their own shoulders at a certain aspect of their lives in an entertaining way."

O'Neill likes to think that people will use this kind of software not only to understand themselves better, but also to understand and improve relationships with others. That people will come home in the evening and instead of asking *What's on cable tonight?*, will play one of his games together. By evening's end, they will have experienced more about each other, like

after a good conversation or a card game.

"I see a potential in software for people to improve and keep a perspective on their lives," he says. "Also for improving relations with friends and family, and having a smile while you're doing it."

From *Snooper Troops* to the recently released *The Other Side*, Tom Snyder has had that same goal in mind. His educational software, often presented in the form of a game, strongly encourages group interaction and entertainment.

Snyder has such definite feelings about using the computer as an interactive medium that when no software publisher would accept *The Other Side* without a one-player option, Snyder's own production company decided to publish it.

"I don't think we were being precious about it," he says. "We had been working on it for so long that it just didn't make any sense to us to teach kids how to resolve conflict with a computer. We didn't know what that meant. That doesn't sound like a significant step, unless you have a genuinely intriguing artificial intelligence model where the computer is behaving with all the delighful complexities of a person. And we're years from that."

The Other Side is a world diplomacy game, a simulation of a group of world leaders trying to co-exist harmoniously while still surviving individually. It can be played by groups of people across a classroom from each other, or across an *ocean*: A modem option lets groups play over the phone.

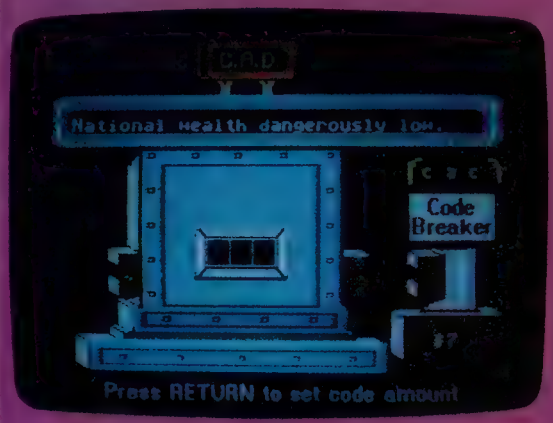
Snyder set up a game between a group of school children in Boston and a group in Geneva, Switzerland. It was the headline story on national television news in Geneva that day.

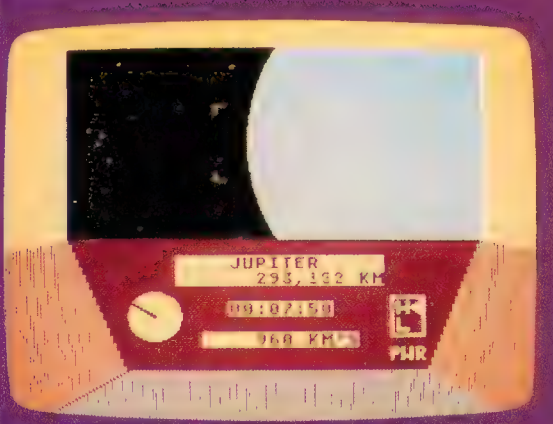
The program's Hotline feature lets players communicate during the game. "At first, these kids from two different cultures were asking questions like, *Have you guys tried new Coke yet?* and *Do you watch Miami Vice?*" says Snyder. "Slowly, as they got more involved in the game, they would say things like, *Let's make a treaty where we don't go near other peoples' countries.*"

Tom Snyder Productions

The Halley Project
The Other Side

The Other Side *promotes group interaction and negotiation in a world diplomacy setting.*





The Halley Project *offers a huge environment for players to explore: the solar system.*

That kind of cross-cultural communication takes *The Other Side* a step beyond a computer simulation. Snyder acknowledges that, but defers to the intricacies of game design and involvement of players.

"A good designer can create a pretty good simulation, but if you provide opportunities for people to have input into the game, it gets 100 percent better.

"I cheat. I let people make my

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Here, Tom Snyder participates with two groups of students playing the game.

games better for me. By putting Hotline in, and requiring more than one person to play, they bring in all sorts of depth and emotional content to a game that there's no way I could have brought in myself. People bring so much to the experience."

But the environment, the world that designers must create for a good simulation, is key to the program's integrity. Two of the elements that make that environment beg to be explored, says Snyder, are *extensiveness* and *consistency*.

"You make it big and you make it real. Not like in the old adventure games where you go right and left and retrace your steps and you're not where you started. It really has to have the feel of a real world. Like in *The Halley Project* (Snyder's solar system simulation published by Mindscape), if you go a couple of million miles in one direction, you really are there. It's not a fake hyperspace map that someone put together."

Many other software designers have developed simulations of real worlds and fantasy worlds for computer owners to explore. Some encourage competition, some cooperation, and some learning. Some foster all three.

When software designer Dan Bunten and his brother Bill were young, they drew a complete naval war game board on the floor of their basement. They and the rest of the design team at Ozark Softscape have been designing world games on computer disks for the last few years. *M.U.L.E.* sent players to an unexplored planet, and gave them tools to build a new civilization. Cooperation was imperative. *Seven Cities Of Gold* simulated the sixteenth-century experience of the Spanish conquistadors setting out to discover the New World. Greed and plunder were possible, but attempts to understand and befriend the natives of this new culture were encouraged. In their latest game, *Heart Of Africa*, you must journey through unexplored areas of the African continent, looking for a tomb that could hold the lost secrets of ancient Egypt. (*M.U.L.E.*, *Seven Cities of Gold*, and *Heart Of Africa* are published by Electronic Arts.)

The Argos Expedition, designed by The Children's Television Workshop for CBS Software, is a journey into the universe to seek, retrieve, and recover artifacts from an ancient culture. The crew must work together in making every decision; at the same time, each member has his or own objective to achieve. Personal gain and group harmony must be balanced for the mission to succeed.

Though there is educational value and personal growth gained from real-world simulations, there can also be enjoyment in exploring fantasy worlds, worlds that might exist in another time or on another plane.

Designers at Activision believe that they may have stumbled onto a new culture, a race of people that lives in a rather unusual environment. According to designers David Crane and Sam Nelson, there's someone living in our computers.

This theory was brought to their attention by a musician who was puzzled by the fact that much

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of the music he programmed sounded different from what he thought he had composed. How else, reasoned Crane and Nelson, could you explain all of the programming problems experienced by seasoned designers? Why would perfectly entered code result in syntax errors and other program bugs?

After months of research, Crane and Nelson discovered that the little creatures wanted a comfortable place to live. So they designed a 2-1/2 story "house on a disk" for the Commodore 64, with a living room, kitchen, bedroom, bathroom, and study/recreation room. It worked: A little person moved into the house. The creatures seemed to like that environment, and one has moved into every house built so far.

This miniature race of people shares several traits. They all eat, drink, and sleep. They read newspapers and books, listen to music, watch television, and work at their computers. They brush their teeth, shower, and exercise. They take good care of their pets. They play games. They get sad occasionally, but can be cheered up by a pat on the head.

The little people can read and write English, so Crane and Nelson put a typewriter in the house to send messages back and forth. When the creatures want to talk, they tap on the inside of the monitor screen. As of yet, their native language is incomprehensible to us.

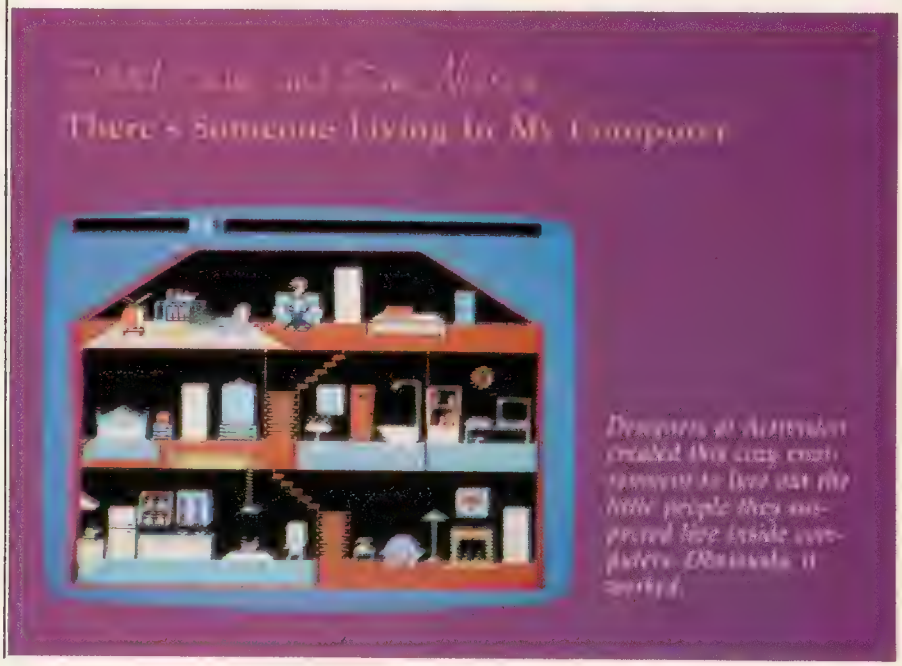
The Activision design team believes that the little people learned about our culture by watching our use of computers. This would explain their ability to read and write English (through word-processing programs), their appreciation for music (through computer music software), and their enjoyment of entertainment (through videogames).

Top management officials at Activision deemed this research significant enough to create a commercial product from it, to mass-produce these houses on disk so that Commodore 64 owners can try to lure the little people out of their own computers. This new software, called, appropriately, *There's Someone Living In My Computer*, should be available in time for Christmas.

(Researchers at Activision recently built a similar house for an Apple II computer, and discovered little people there, too. They will continue to observe the little people and issue periodic updates in the form of commercial software.)

No videogame designer claims to have the one and only key to computer entertainment. They all approach projects with an eye towards what consumers want, what they enjoy designing, and what their varied backgrounds have taught them about peoples' needs. Tom Snyder's experience as a schoolteacher and musician may take him in a different direction from John O'Neill's artistic history, but both are sensitive to the opportunities for interaction and growth within the bounds of electronic entertainment.

And though the means are different than they were ten years ago, O'Neill's found that the end is the same. "I'm making games for people who think and feel, games for people who like to have products which will help them keep pulling the skin back from their eyes so they keep feeling and sensing, which I think is the role of the artist in society anyway."



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Mitey Mo turns your Commodore 64 into a telecommunications giant. It's the best-performing modem with upload/download.

Mitey Mo is being hailed as "the best price/performance communications package available." Its software has received the endorsement of the U.S. Commodore Users Group, which gives a money-back guarantee to members. It is truly the industry standard, and no wonder. It's the most user-friendly modem you can buy—it will take you online faster and easier than anything else.

Mitey Mo opens up a world of practical and exciting uses for your C-64. It lets you send and receive electronic mail, link up with community bulletin boards, play computer games with people in distant places, tap into library resources, and much more. All at your convenience.

Until Mitey Mo, Commodore's 1650 Automodem was the obvious choice when you went looking for a modem for your computer. Like Mitey Mo, it has "auto answer"—it receives data while unattended. And both modems are "auto dialers"—you dial right on the computer's keyboard. But that's about where the similarity ends.

Mitey Mo can dial up to 9 numbers sequentially. But suppose you dial a number and find it's busy. Mitey Mo has "auto redial"—it hangs up and redials immediately until it gets through. With the other modem you have to redial each time—and somebody with auto redialing can slip in ahead of you.

Mitey Mo is menu driven. It lists the things you can do on the screen. Select a number and you're on your way. Since Automodem isn't menu driven, you'll be hunting through the manual a lot.

With Mitey Mo, your computer's function keys are programmable—you can save yourself plenty of keystrokes. Not so with the other modem. And only Mitey Mo lets you store data to review or print it later.

Mitey Mo has just one switch, the Smart 64 software does the rest. With the other modem you'll have to remember to check three switches, otherwise you may be answering when you mean to be originating.

Mitey Mo is half the size of the other modem. The very latest technology allows miniaturization and increased reliability, as well. Mitey Mo is so reliable, we gave it a full three-year warranty. The other modem gives 90 days, then you're on your own.

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VT-52/VT-100 Emulation	YES	NO
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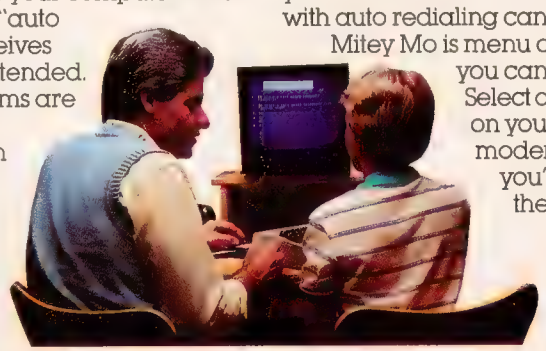

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Building Your Own Games

Selby Bateman, Features Editor

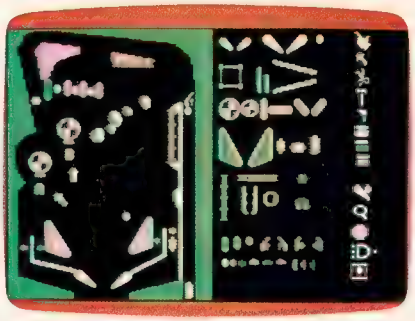
In any conversation about innovative game design, Bill Budge's *Pinball Construction Set* is almost certain to be mentioned. This computer simulation of a pinball machine sparked an entire genre of computer games: the construction set. *Pinball Construction Set* is already considered a classic in the short history of microcomputer games, and is likely to remain so for a long time.

The concept behind a construction set is simple—it is a collection of building materials and tools which let you create your own program within the computer. No special programming knowledge is required since the program presents you with a series of easy to follow menus and graphic icons, or symbols, which you manipulate to build your own program. A construction set doesn't have to be a game. There are now construction sets, whether called by that name or not, for a variety of applications.

Steve Wozniak, one of the cofounders of Apple Computer, once described *Pinball Construction Set* as the most powerful program ever written for an eight-bit machine. Whether that's still true or not, just a few minutes with any of the versions of the game—Apple II, Commodore 64, or Atari—will give you an idea of what he was talking about.

Not only did Budge introduce and then popularize an excellent concept, he carried out the idea with some of the best graphics and sound programming ever created in a computer game. In addition to five preprogrammed pinball games on the disk, *Pinball Construction Set* also presents a couple of dozen different pinball machine parts, including flippers, bumpers, slingshots, ball eaters, spinners, and polygons. You take these parts and create your own pinball environment. Change the laws of gravity if you like. Use an invisible ball. Build new shapes never before seen on a pinball machine. You can have as many as 128 parts on the screen at once.

Why was pinball the first thing Bill Budge wanted to try with his construction set idea? After all, Budge didn't even *play* pinball when he started. But, as he remembers it, many of the engineers at Apple were hooked on pinball. "Woz and Andy Hertzfeld and other Apple II heroes, people I admired, were fanatics about pinball. It got to be a craze; everyone bought machines, although I never did. And to this day, I like pinball, but I'm not a fanatic. They taught me everything I know about it."



Pinball Construction Set *offers a menu of machine parts (on the right) and a pinball palette.*

After playing *Pinball Construction Set* for a while, many people discover what Budge first realized: It's more fun to create your own games than to play someone else's.

Other game designers quickly found out the truth in that. *Music Construction Set* and *Adventure Construction Set*, both by Electronic Arts (which also sells *Pinball Construction Set*) are two program builders which use the same concept carried out in different ways. The company is now taking the idea another step with its *Video Construction Set*, an advanced graphics program for the new Amiga computer.

Bill Budge, creator of Pinball Construction Set

Codewriter Corporation markets a game builder for the Commodore 64 called *AdventureWriter*, which lets you create your own text or graphics-and-text adventure games. Other computer games which let the user build-in all or many of the parts of the program are Brøderbund's *Lode Runner*, Sub-Logic's *Night Mission Pinball*, and Mastertronic's *The Games Creator*.

What's the next step in building your own games? How about *Construction Set Construction Set*? Don't laugh. That's exactly what Bill Budge is working on: a program which lets you build a variety of other programs without learning a computer language. Not just games, says Budge, but all kinds of software.

"I could build anything from *Pacman* to *Missile Command* to a very, very powerful programming language. It's the kind of a program that has a very wide application," he says. "A physics teacher, for example, could build all kinds of simulations, of little micro-worlds, set up different labs and provide dynamic little worlds that aren't really video games."

Although still in the design stage, *Construction Set Construction Set* is one more step in Budge's long-held belief that there's always something new to be discovered within a computer.

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GAMES

AT THE SPEED OF LIGHT

Selby Bateman, Features Editor

Tomorrow's computer games will go far beyond the blocky graphics and limited music and sound effects found on the best of today's micros. Laser-driven optical technology is already capable of bringing motion picture quality animation, live-action images, and stereo sound to videodisc arcade games, educational lessons, and training courses. The next logical step for this optical technology is its connection to your personal computer.

You push forward on the joystick and your space fighter swoops down between narrow canyon walls, jagged rocks sweeping by within inches. Suddenly, you spot enemy spacecraft. You fire rockets, pull back on the joystick, and the chase is on.

The images in this scenario appear as real as those you would see in the latest science fiction movie. And yet, you're controlling your fighter—a computer-generated sprite—through your computer, and the lifelike images are produced by an attached videodisc player. In fact, this demonstration occurred a year ago here at the GAZETTE, when a videodisc player was connected to an eight-bit Japanese computer. This type of fast-action arcade game is but one example of what's possible with today's computer-controlled videodisc.

Laser videogames such as *Dragon's Lair*, *MACH 1*, and *Space Ace* have been in the arcades for a couple of years now. They feature full stereo sound and either live-action footage or movie-style animation.

But arcade games aren't the only uses for videodiscs. They're widely accepted as teaching and training tools in education and business. It's only within the past couple of years that a sizeable number of manufacturers have been producing interfaces which connect videodisc players to computers. (See "The Videodisc Connection" elsewhere in this issue.)

The proliferation of terms associated with these laser-driven products is at first confusing—videodisc, laser disc, optical disc, compact disc (CD), and now, CD-ROM (compact disc-read only memory). What they all have in common is a laser beam. And lasers and computers are coming together in a variety of ways.

At its simplest level, a videodisc (also called a laser disc or optical disc) is little more than a 12-inch plastic record which uses a

low-power laser beam to read a spiral set of album tracks, much like a conventional stereo turntable uses a diamond-tipped stylus. The laser beam has random access to the information on the disc, similar to the random access of a computer floppy disk. While a floppy disk uses a magnetic storage technology, a videodisc has its information entered as tiny pits on the plastic record. The laser reads the pits, as the videodisc spins at speeds up to 1,800 rpm. The storage capacity of a videodisc is more than 100,000 still frames, with each of those frames accessible by the laser within a fraction of a second.

There are videodisc players available from Pioneer, Sony, Hitachi, and others. But despite the promise of videodiscs, there are currently only some 200,000 players in homes, schools, and businesses in the U.S. As videodisc entrepreneur Allen Adkins says, every year someone tells him that *this* is the year that videodiscs will take off and become a mass market item. Although it hasn't happened yet, Adkins and many others are taking part in a related industry boom which is having dramatic effects on the future of videodiscs.

The name of the boom is CD (compact disc), an optical audio recording format which uses digital encoding of information and can store up to 550 megabytes of audio data. CDs have been very popular among audiophiles for the past year or so. Now, lower priced CD players and a growing library of recordings available on the small (4.7 inches) discs are turning these audio machines into mass market items.

Already, some manufacturers are preparing dual-purpose players which will run audio CDs and videodiscs on the same machine. For example, Pioneer's CLD-900, priced at about $1200, will play both audio CDs and videodiscs.

Another important development has been the introduction of CD-ROM players, digital compact disc players with the data storage capacity to include entire encyclopedias on just part of a disc. The information can then be read by your computer. (See "CD-ROMs: The Ultimate Database" in the November GAZETTE.)

"The consumer CD and CD-ROM are going to do a lot to popularize laser discs," says Adkins,

Videodisc-based kiosks are in use as information booths and point-of-purchase displays in many stores, airports, and hotels.

The Videodisc Connection

Linking your Commodore 64 or 128 to a videodisc player is getting easier all the time, thanks to the growing number of companies making interfaces and supporting software for that purpose. In fact, no matter what kind of computer you have, there are more and more videodisc connectors becoming available.

Allen Communications, for example, manufactures the $149.95 Allen MVP (Most Valuable Peripheral) Interface which will connect a Commodore, Apple, or Atari computer with many videodisc players, such as those made by Pioneer, Sylvania, Magnavox, and others. With the package, you also receive software which shows you how to use the system, and helps you learn how to design your own programs. This and other Allen systems are used in educational, marketing, and entertainment applications.

In addition to developing your own programs, you can purchase an array of prepackaged videodiscs which have been created specifically for use with a computer—games, educational packages, and training programs.

The MVP interface lets Commodore 64 and 128 users connect their systems to a variety of videodisc players.

president of Interactive Arts International, a videodisc software development firm, and of Optical Media Services, a company which helps software firms put their information on CD-ROMs. Adkins expects to see computer games using CD-ROMs available in 1986. "The longer-term market for 12-inch videodiscs is pretty good, especially in storing information for educational purposes," he says.

Without realizing it, many people have used videodiscs while shopping or travelling. An increasing number of shopping malls, airports, and retail stores have videodisc kiosks, stand-alone information centers which provide information at the press of a button.

Let's say you've just flown into Chicago and want to get some information about restaurants in the city. In the lobby of your hotel is a computer-controlled videodisc hidden within an attractive kiosk which has a variety of information for visitors. On the monitor, you see a menu of options, including one labelled RESTAURANTS. Pressing the number next to the label, you see a second menu which lists types of cuisine: Italian, French, Greek, American, Chinese, and so on. You choose one, and the videodisc quickly lists dozens of restaurants and their locations. You again make a choice, and a menu for that restaurant appears on screen. With each key press, the laser beam is skipping from topic to topic.

This same kind of application is being used in corporate training programs, self-paced college courses, and retail product demonstrations, to name only a few. The same techniques used in these videodiscs for education and business have also been applied to games.

For instance, in 1981, a videodisc game for the home called *How To Watch Pro Football* was available. The disc offered scenes from NFL games, and the user tried to predict what plays would be called. Other videodisc releases have included *The First National Kidisc*, a children's games package; *Murder Anyone?*, a murder mystery in which players tried to guess the murderer; and *Astron Belt*, a *Star Wars*-style action game.

One of the most successful

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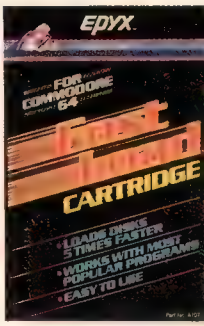

EPYX

The MVP is controlled through one of the joystick ports on the Commodore 64 or 128 (a cable is provided). Functions such as PLAY, PLAY TO, FIND, STEP FORWARD and REVERSE (at designated increments), and SLOW, plus many more are included. The Allen interface also lets you control the video display through software commands, and switch from computer video graphics to videodisc video (live action or still frames). The product comes with a prepackaged demonstration of MVP functions.

Allen Communication, which has extensive experience in videodisc technology for education and business, also provides other interface systems for Apple and IBM computers.

Two other companies involved in Commodore 64 videodisc usage are Touch Technologies of Escondido, California, and MicroEd, Inc., of Minneapolis. Touch Technologies markets the $149 CLAS-LD (Computerized Lesson Authoring System—Laser Disc) software-hardware combination, which works with a Pioneer LaserDisc player (about $800) and Touch Technologies' LaserVideo Controller interface ($200) connected to a Commodore 64 or 128.

There is also a version for the IBM PC/PCjr/XT/AT and compatibles: $229 CLAS-CBT (Computer-Based Training) software, LaserDisc, and Pioneer IU-04 interface ($250) connected to an IBM computer.

The CLAS system lets nonprogrammers create video images and computer text on the same monitor for computer-based education and training. With its emphasis on flexibility and ease of use, the potential applications are extensive.

MicroEd sells a $29.95 software package for the 64 which is used in conjunction with North American Philips' commercial laserdisc covering the life and works of Vincent Van Gogh. The company, under the direction of Thorwald Esbensen, has been investigating educational uses of videodiscs for over five years.

One example of the company's work during the past couple of years has been its involvement with the LaserSoft educational software project. Working with the Society of Visual Education (SVE) in Chicago, Esbensen developed a flexible videodisc-based educational system centered on images chosen from approximately a half-million photographs in the SVE library. Touch Technologies developed the Commodore 64 interface controller for that system.

While the marriage of videodiscs and computers is still in its infancy within the consumer market, there are already a couple of dozen companies which can provide product information on videodisc-computer interfaces. Listed below are those companies which currently have Commodore 64/128-videodisc interfaces and/or software. Additional interfaces for the Commodore may be forthcoming from other companies as well.

Allen Communiation
140 Lakeside Plaza II
5225 Wiley Post Way
Salt Lake City, UT 84116

Learning Link Corp.
2880 South Main
Suite #111
Salt Lake City, UT 84115

MicroEd, Inc.
P.O. Box 24156
Minneapolis, MN 55424

Systems Impact, Inc.
4400 MacArthur Blvd. NW
Suite 203
Washington, DC 20007

Touch Technologies
609 South Escondido Blvd
Suite 101
Escondido, CA 92025

videodisc-based ventures was a game called *Dragon's Lair*, produced by Don Bluth Animation. This classically animated game created a short-term sensation in video arcades when it was released several years ago. A similar production from Bluth, *Space Ace*, uses the same kind of animation and stereo sound. Players make split-second decisions as they navigate through the onscreen perils.

Despite the excitement of videodisc-based games, the relatively high production costs and expensive retail prices of videodiscs have kept sales and demand far below today's VCRs and the new CDs.

"But let me tell you what we just ran into that's going to put a completely different complexion on this whole market," says Thorwald Esbensen, president of MicroEd, Inc., a software development company which has been involved with videodisc technology for more than five years.

The classic animation and interactivity of videodisc games such as Space Ace *go far beyond the graphics of today's computer games.*

"The new Amiga from Commodore. You can take images, either still frames or motion frames, off laser discs or videotape and embed them on the Amiga disk, then use them in your program. And you can also take prerecorded music or voices and embed those in your program," he says. "That's going to be a new and potentially very potent market. It's going to combine in one unit the dynamic features of laser discs, videotape, music, and your micro stuff all together."

With the computer hardware advances of the Apple Macintosh, the Amiga, and the Atari ST, plus the related software improvements, Esbensen and many others are betting that laser disc technology is now going to move forward at a much faster pace.

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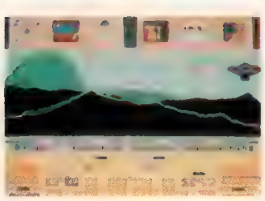

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	C64/128	ATARI	APPLE
Koronis Rift	✓	✓	✓

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Strategy Games for the Action-Game Player™

Whirlybird

Philip I. Nelson, Assistant Editor

This hyperactive bird lays some rather unusual eggs. A fast action game written entirely in machine language for the Commodore 64. A joystick is required.

"Whirlybird" is a fast, updated version of the classic game *Breakout*. It's written entirely in machine language. You control the Whirlybird, who flies back and forth at the top of the screen, spinning continuously. The goal is to clear out the layers of colored bricks at the bottom by bouncing eggs against them. When an egg moves back in your direction, move the Whirlybird into its path to bounce it back down. The game ends when you clear the field of bricks or run out of eggs.

Starting Up

Whirlybird must be typed in with the "MLX" machine language entry program published frequently in COMPUTE!'s GAZETTE. If you're using tape, change **POKE782,1** to **POKE782,0** in line 763 of MLX before running MLX. Read the MLX instructions before you begin typing, and be sure to save a copy of Whirlybird before running it. Here are the addresses you need for MLX:

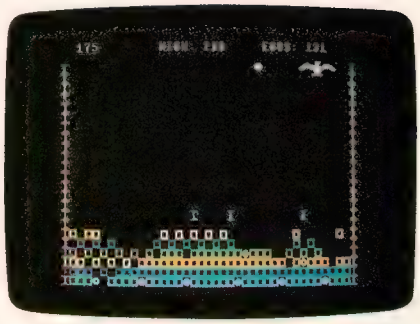
Starting address: 49152
Ending address: 52241

Plug a joystick into port 2, then load and run Whirlybird as if it were a BASIC program. *Do not try to start the program with SYS.* The playfield appears immediately, with the Whirlybird twirling across the top of the screen. On either edge is a sparkling row of sidebeams, and below are multicolored rows of bricks. At the upper right is the number of eggs you'll have in this game. Though the usual number is ten, you can get a smaller or larger number (up to 255) by pushing the joystick backward or forward. (Don't select zero—you'll simply return to the startup screen.)

Next you must pick the skill level. Press f1 to play a normal game or f3 for an expert game. At the expert level, the Whirlybird is only half its normal size, making it harder to hit the eggs. After choosing the level, the prompts disappear and play begins.

Press the fire button to release the first egg. You earn one point every time you hit a brick, and ten points every time you bounce an egg back down with the Whirlybird. Letting the egg fly past you into space subtracts ten points from your score (unless it's already under ten). When that happens, the sidebeams sparkle continuously until you press the fire button again to release the next egg. Play continues until you lose all your eggs or clear the field of bricks. A 50-point bonus is awarded for clearing every brick from the screen.

In addition to normal bricks, the playfield contains a few round ones. When the egg hits one of those, the Whirlybird swoops down to deposit a sidebeam somewhere above the playfield. This doesn't affect your score, and you get a free egg as well (press the fire button to release it). However, the extra sidebeams add an extra element of uncertainty since the egg rebounds sideways from them (not up and down) and they may or may not disappear when struck.



The whirlybird has just flown past an egg. This machine language game uses interrupt-driven routines to spin the bird and move it smoothly across the playfield.

Whirlybird displays your current score as well as the highest score attained during the current session (which may include more than one game). When a game ends, both scores are displayed until you release the first egg in the next game. Then the current score is cleared to zero. Since the high score is stored within the program code, you can record it for future comparison by resaving the game after each session ends. (It's a good idea to resave it with a different filename—like "BIRDHIGH"—to distinguish it from the original copy, which then serves as a backup.) The next time you load and run Whirlybird, it displays the previous highest score.

The Joystick Accelerator

It may take some practice to master the joystick motion in Whirlybird. Rather than zooming immediately to the spot you want, the bird moves in an elastic manner that simulates the inertia and momentum of a natural object. It takes a bit of pushing to overcome the bird's inertia and get it moving. The longer you push in one direction, the more speed and momentum you

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	C64/128	ATARI	APPLE
The Eidolon	✓	✓	✓

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gain (up to a point). After you let up on the stick, the bird slows down and eventually stops by itself. Hitting the sidebeam reverses your direction immediately. Reversing direction in midscreen may take a long or short time depending on your speed.

You might think of the joystick in this game as a gas pedal in a car. Keeping your foot on the accelerator makes the car move faster and faster. Let up and the car gradually slows down. Learning to control the acceleration takes some time. You may find it more effective to move the Whirlybird with short taps on the joystick, rather than long periods of acceleration.

Egg Juggling

The direction an egg bounces when it hits the Whirlybird depends on which way you're pressing the joystick. If you're not pressing it left or right, the egg rebounds as if the bird were a solid wall. If you're pressing the stick left, the egg bounces to the left; if you're pressing right, it bounces to the right. This lets you control the direction of every bounce. But don't move the stick so much that you miss the egg completely.

The result of a bird-egg collision also depends on what part of the bird you hit. The safest strategy is to hit the egg with the bird's feet. Bouncing it off a wing is more dangerous, since the bird never stops turning. If the egg arrives when the wing is outspread, you'll usually get a normal collision. But if the Whirlybird happens to be facing sideways—making it very slim in profile—the egg may miss completely.

Occasionally a wing collision causes the bird to juggle the egg briefly. Juggling gives you extra points and may also change the angle of rebound slightly (a boon when you're short on eggs and need to clear the last few bricks). But it's also dangerous, since the bird may juggle the egg upward and out of play. Juggling occurs less frequently at the expert level; with smaller wings it's more difficult to get multiple collisions.

Rings And Filters

Whirlybird's unusual sound effects are created with two voices of the 64's sound chip. Voice 3 is used as a random number generator (to pick a random screen position and direction for each new egg) and doesn't produce any sound. Voice 1, set for a pulse waveform, makes a "boing" sound when an egg bounces, and voice 2 creates low, thrumming tones in the background with a ring modulated triangle wave. The vibrato-like effect results from ring modulated overtones that slowly pass in and out of phase with the frequencies of voices 1 and 2.

These sounds are made more interesting by passing them through a combined lowpass/bandpass filter and sweeping the filter's cutoff frequency up or down in conjunction with other game events. When you start the game or when the egg is flying freely, the cutoff frequency sweeps up and down, creating a gradual *meow-meow* effect. When the egg hits something, the cutoff frequency is set high and swept rapidly downward to accentuate the bouncing noise.

See program listing on page 147.

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Quickchange

Kevin Mykytyn and Mark Tuttle

You'll need a good strategy and fast reaction time to succeed in this mind boggler. Three games in one for the Commodore 64. A joystick is required.

Are you ready for a challenge? "Quickchange"—three games in one—requires logical thinking, manual dexterity, and a good strategy. If you work quickly and stay cool, you should be able to survive for a few rounds. None of the games is easy to master. The three games use the same board and have the same basic format, but each has a different twist.

Quickchange is written entirely in machine language, so "MLX" (published frequently in this magazine) is required to type it in. After loading and running MLX, respond to the starting and ending address prompts with 49152 and 51227. Type in Quickchange and save a copy. To load the program, type LOAD "QUICKCHANGE",8,1 for disk or simply LOAD"QUICKCHANGE" for tape. When it's finished loading, enter SYS 49152. Be sure to have a joystick plugged into port 2.

You're first presented a menu with a selection of three games: Flip Flop, Missing Pieces, and No Turning Back. Move the arrow with your joystick to select a game, and press the fire button to start. It is suggested that you start with Flip Flop and progress to No Turning Back.

Flip Flop

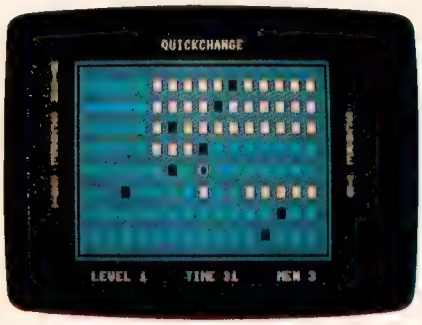
The playing field is a 120-square grid, 8 rows by 15 columns. You're represented by the black circle starting at the center of the grid. Eight black pieces, one in each row, start at the left and move across the grid. Each moves at a different rate of speed to the far right edge and then returns, and so on. Contact with one of the black squares costs one player (you begin with three).

The object of the game is to move your piece around the grid and change the color of all the squares from pink to blue (different colors in successive levels) while avoiding the moving black squares. And all this must be accomplished in 60 seconds. Moving into one square instantly reverses its color. It's important that you choose your course carefully. Backtracking over blue squares changes them back to pink. When you complete the grid (change all squares to blue) within the allotted time, you advance to the next level. For each successive level, the speed of the black squares increases. It doesn't get any easier.

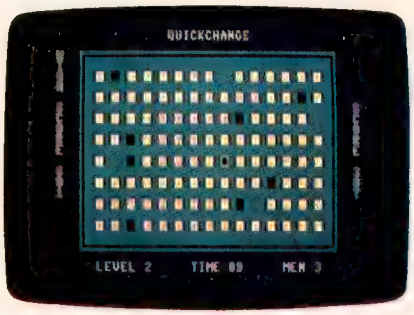
One point is awarded for each square you flip to blue. However, once a square is flipped, you do not receive any additional points for flipping it again. You lose a point for changing a square to the wrong color and gain back the point when it's changed back to the right color, so your score can move up and down. You receive 100 bonus points for each level completed. Throughout the game, current score, high score, current level, time remaining, and number of players remaining are displayed. The game can be paused at any time by pressing SHIFT or SHIFT LOCK. Release it to resume play. The game is over when you've used all three players or when time runs out.

Missing Pieces

The play in this game is nearly identical to Flip Flop. But there's a



There's plenty of time to finish this screen in "Flip Flop."



In "Missing Pieces," you must avoid falling into the empty spots.

The squares disappear after you travel over them, making "No Turning Back" the most challenging variation.

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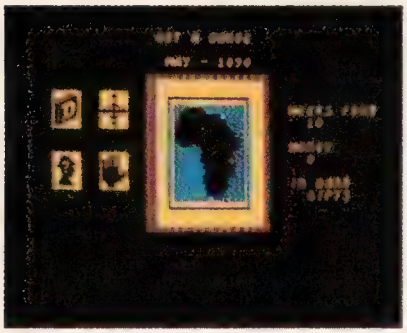

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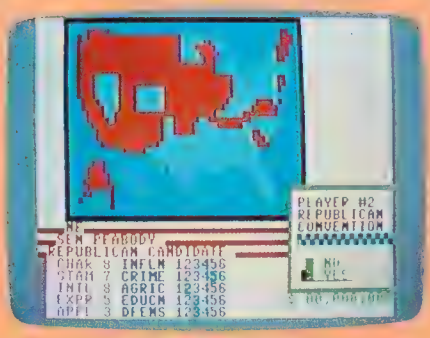

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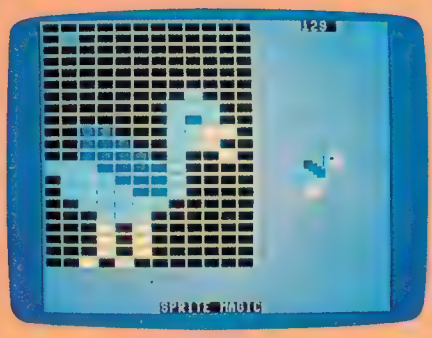

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twist. Several pieces—randomly selected each time you play—are removed, thus creating empty spaces—*holes*. If you happen to leap into one while hurrying along, you lose one of your players. Unfortunately, the black squares are unaffected by these empty spaces. They move through them as if they weren't there.

The scoring and rules from Flip Flop apply to Missing Pieces.

No Turning Back

This is the most exciting—and most difficult—of the games. The playing board is the same as Flip Flop, but the object of the game is different. Once you move away from a square, it's erased. The goal is to eliminate the squares (you are credited with clearing the board if three or fewer remain).

Moving into an empty space is not allowed. But, unlike Missing Pieces, the black squares cannot move into the voids. They'll reverse direction if they encounter one of these spaces. This can be used to your advantage. You can cut off a black square by removing the squares horizontally adjacent to it. This will erase a black square and free up an entire row. For each black square removed, 100 points are added to your score (plus 1 point for the space previously occupied by the black square).

This game is trickier than the others. In haste, it's easy to isolate your own player. Remember, the object is to eliminate the squares, and you can't enter a voided space. Also, be aware that when you lose a player—provided it's not your last—your next player is positioned in the center of the screen. If there are no available pieces adjacent to the center, you've eliminated yourself from the game.

There's A Way To Win

The key to success in each of these games is to find the right pattern. There are several that will work. If you randomly move around the maze, you'll find that although you can accumulate points, you'll probably run out of time.

Quickchange may be played competitively for highest score or just for the challenge of completing a level or two.

See program listing on page 149.

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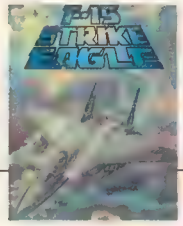

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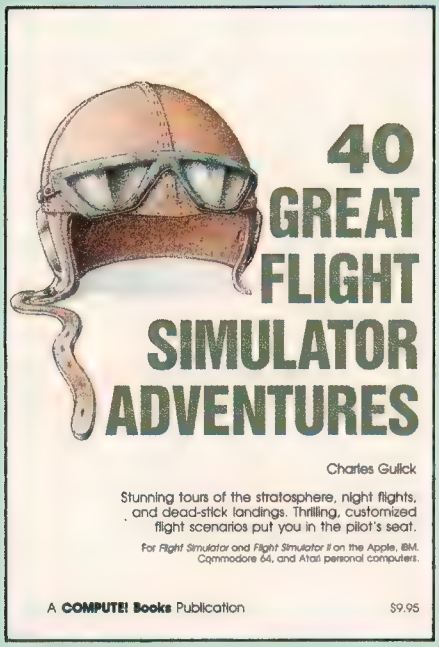
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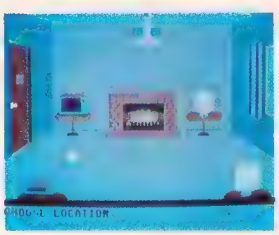

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How To Play

"Dragon's Den" is an all BASIC game for the 64, Plus/4, and 16. As listed, the program runs on the 64. If you have a Plus/4 or 16, substitute this line:

```
100 Y=826:COLOR 4,1:COLOR 0,1:
    PRINT"{CLR}{5 DOWN}{5
    {7 SPACES}D R A G O N ' S
    {3 SPACES}D E N"
```

After typing the program in, save a copy. Type RUN to play. First, a message appears to tell you that the maze is being drawn. After a short pause, you find yourself in a chamber somewhere in the dungeon of the castle. (Each time you play, you start in a randomly selected chamber.) The screen presents a three-dimensional perspective of the room and a directional marker indicating which way is north. At this point, you're given several choices of commands at the bottom of the screen.

To select one of these, press the first letter of the appropriate word (L for left, for example). You'll always have at least four of these options at any point in the game:

Chart: Shows your present location within the castle dungeon as well as where you've been. Indicates where you've left bread with an M (for Mark). Press any key to resume play.

Mark: Deposits a bread slice in the current chamber. A message appears to indicate how many bread slices you've used (you begin with 20). By leaving bread, you can mark any chamber for future reference. If you leave all 20 slices, however, you starve to death.

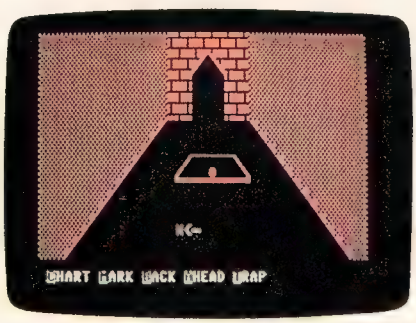
Back: Moves you to the chamber opposite the direction you are facing, like taking a step backwards.

Left: Moves you to the chamber on your left (a door appears only if there is an entrance to the chamber).

Ahead: Moves you to the chamber directly in front of the one you are currently in (a door appears only if there is an entrance to the chamber).

Right: Moves you to the chamber on your right (a door appears only if there is an entrance to the chamber).

Trap: Lifts the trap door. You could find a magic sword that slays



Will there be treasure, water, or a dragon under the trap door? You're faced with a number of choices in each room in Dragon's Den. In the photo on the right, the player has pressed C (Chart) to find his present location as well as where he's been.

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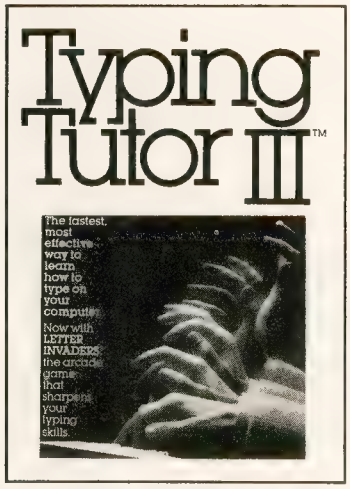
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Little People Inside Your Computer:

How To Make Contact

We've known for some time that small human-like beings live inside your computer. No news there. What *is* news is that Activision scientists—the same crack research team that first made contact with the little guys—have now made it possible for Commodore 64/128 and Apple II series owners to meet the inhabitants of their computers.

Yes, the most amazing scientific quest of modern times can now be duplicated in the comfort of your own home, thanks to The Activision Little Computer People Discovery Kit.™ But first, for those who've been vacationing on Mars, a little more background.

Little Computer People (LCP), of course, are the ones responsible for that thousand-digit error in your phone bill, for that police officer mistakenly believing you haven't paid your parking tickets, for the syntax errors you get back after you've fed your computer a perfectly good piece of code.

Turns out, the little folk only cause all that mischief because they feel neglected. Treated properly, they're as pleasant and sociable as you or me.

Thanks to the revolutionary "house-on-a-disk" perfected by Activision scientists, LCP can now be lured out of the circuit boards and into the light of day. And fascinating things are being learned.

They seem to have quite a bit to say. They'll tap on the inside of your monitor screen until they get your attention, then pound out messages on their typewriters. They also enjoy playing songs, dancing and playing card games.

Though they share many common traits, the little folk are as individual as Big Regular People (BRP). Consequently, Activision researchers consider it vital that as many computer owners as possible use The Activision Little Computer People Discovery Kit to meet as many LCP as possible. The Discovery Kit includes The Little Computer People™ House-On-A-Disk™ Research Software that is guaranteed to lure out an LCP; the computer owner's guide to the care of, and communication with, Little Computer People; deed of ownership for the House-On-A-Disk; and a special edition of *Modern Computer People* magazine—all the tools needed for observation, interaction, communication and, perhaps, a meaningful relationship.

We recommend that you join the quest immediately. Unless you *like* being the victim of all those "computer errors."

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a dragon, or gold, or water. Or you may be unlucky enough to unleash a lurking dragon.

Making The Right Moves

The main goal of Dragon's Den is to escape from the dungeon of Castle Dunsmore. The secondary goal is to escape with as much gold as possible. (If you wish to play competitively, take turns and see who can gather the most gold pieces.)

You need to find an exit. By regularly checking your position with the Chart command, you can monitor your progress. The exit is on an outer wall. In your haste to find your way out, don't forget to nourish yourself. It's tempting to hurry through the castle dungeon in search of an exit, while avoiding trap doors. But it's risky. You could run out of food if you leave all your bread slices, or run out of water, which is sometimes found under a trap door.

It's possible that you could escape from the castle dungeon without ever lifting a trap door. But it's not likely. Since water can be found under the trap doors, you'll need to open them. Also, if you're playing to collect as much gold as you can, you'll want to open most, if not all, trap doors. You run the risk of encountering a dragon every time you open a trap door. If a dragon appears, one of three things can happen: you slay him *if* you have a magic sword (found occasionally under a trap door), you evade him by running, or you become a quick lunch.

When you press T (for Trap), the door opens. If you see a pair of beady eyes, you have about two seconds to run. Press one of the movement keys (Left, Ahead, Right, or Back) immediately. But be sure to press one which corresponds to an exit. For example, if you hastily press R and there is no door to the right, the game ends in a rather unappetizing manner. You're then asked if you wish to play again.

When you make it to an exit, you have the option of leaving the castle (ending the game) or hunting for more gold. Those who are playing to collect the most gold may stay in the castle and search for more. There is no time limit.

See program listing on page 146.

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Doug Smoak

Make your own custom banners with this flexible and easy-to-use program. For use with Commodore and Commodore-emulating printers. Versions for the 64, Plus/4, 16, and VIC-20.

Put your computer and printer to creative use with this short BASIC program. "Banners" is flexible and easy to use. It's menu driven, and it allows you to select the height and width of the characters that comprise your banner. The program also allows you to print out custom (redefined) characters, such as foreign language letters, and special math or scientific symbols.

Selecting From The Menu

Type in the appropriate version for your computer—Program 1 for the 64, Program 2 for the VIC-20, and Program 3 for the Plus/4 and Commodore 16. After saving a copy, load and run the program. Be sure your printer is turned on and the device number set to 4. You're first presented with three choices: U (uppercase and graphics), L (upper/lowercase), or C (custom character set). After pressing one of these letters, you're asked to choose which character you wish to use to fill in the large letters for your banner (see the accompanying figures for an example). You'll find that certain characters make lighter or darker banner letters.

The next prompt asks for your message. Type it in from the point where the cursor appears (do not cursor left before starting). Your message can go up to two screen lines. After typing a word or message, press RETURN. The next prompt asks how tall your letters should be and offers a choice of 1–9. The smallest size (1) is the height of seven normally printed characters. Choosing 2 yields a letter 14 characters high, 3 a letter 21 characters high, and so on up to 9, which is 63 characters high.

Next you're prompted for the width. The maximum width allowed is determined by the number you pressed for height. If you chose 9 for height, you'll have a choice of 1–9 for width. If you chose 4 for height, you'll have a choice of 1–4. After selecting a width, the printing begins. When the banner is complete, you're asked to press X (to exit the program), R (to reprint the message), or N (to enter a new message).

Helpful Hints

Remember that larger letters take more time to print. So if you have more than one message to print, you might consider smaller letters. This is important if you're making banners for children or if people are taking turns. Also, consider that the "blocky" look of the letters is more obvious in the larger sizes unless they're to be viewed from a distance.

Modifications For The 1526 And MPS-802

The programs should work as is on the 1525, MPS-801, and MPS-803 (if you have a non-Commodore printer, make sure the interface is set to emulate a Commodore printer).

Line spacing is handled a little differently on the 1526 and 802 printers, so you'll have to make some minor changes. First, add this line at the beginning of the program:

```
1 OPEN 6,4,6: PRINT#6, CHR$(27):
  CLOSE6
```

This adjusts the spacing between lines to 27/216, or eight lines per inch. If you want the characters closer together, use a smaller number in the CHR$ function. For more space, insert a larger number.

Next, change CHR$(8) to CHR$(32) in lines 360 and 390 (lines 340 and 370 of the VIC version).

Using Custom Characters

Each version of "Banners" allows you to print out your own custom characters. If you're a seasoned programmer, you've probably worked with custom characters before. If you're new to programming and interested in learning how to create your own custom characters, refer to the *Commodore 64 Programmer's Reference Guide* (pp. 108–114) or any of the following COMPUTE! books: *Creating Arcade Games on the 64, Commodore 64 Graphics, COMPUTE!'s First Book of Commodore 64, COMPUTE!'s First Book of Commodore 64 Sound and Graphics, COM-*

Figure 1

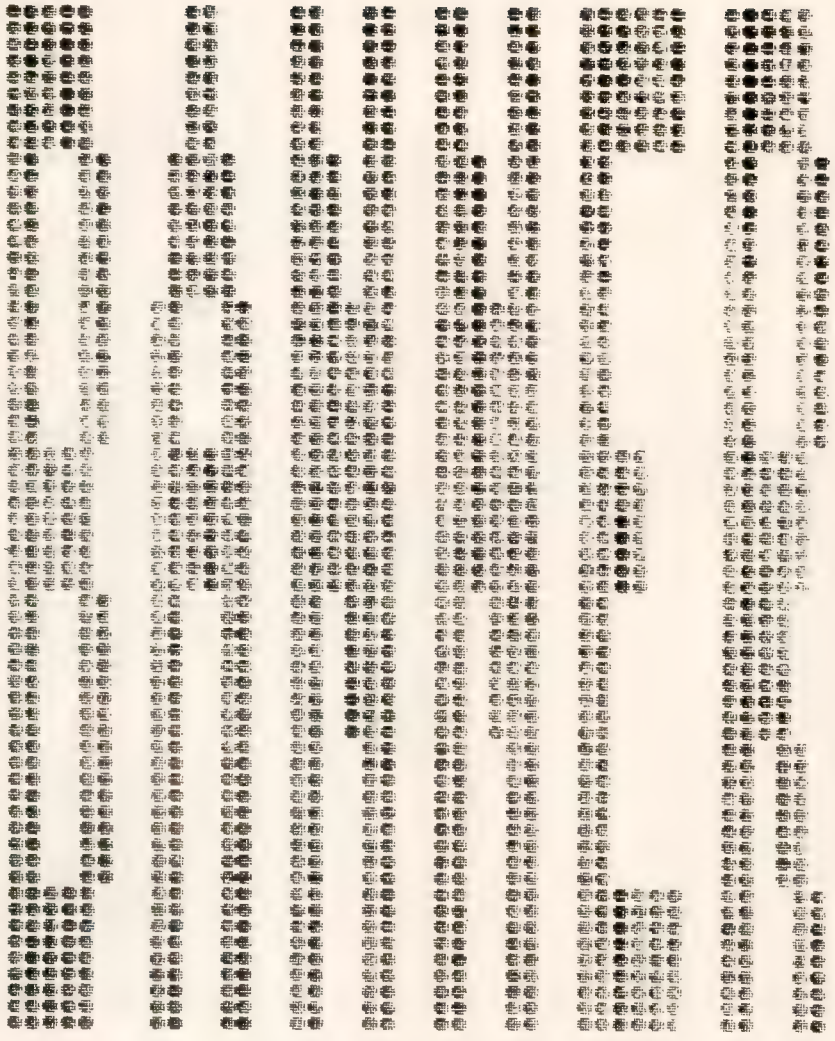


Figure 2

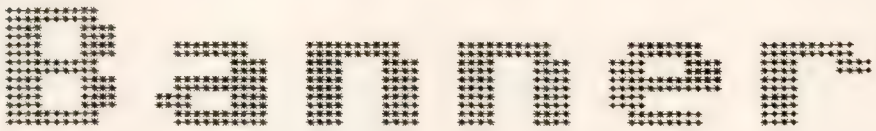


Figure 3

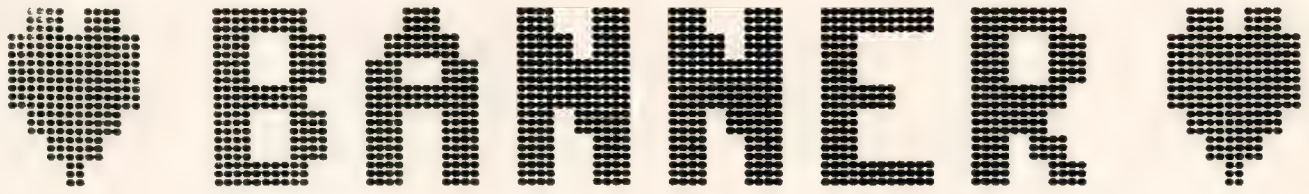


Figure 4

PUTE!'s First Book of VIC, or *COMPUTE!'s Second Book of VIC*. If you have a Plus/4 or Commodore 16, refer to the *Programmer's Reference Guide for the Commodore Plus/4* (Scott Foresman & Company, 1900 East Lake Ave., Glenview, IL 60025). Commodore 16 owners can use the technique described in the Plus/4 reference guide.

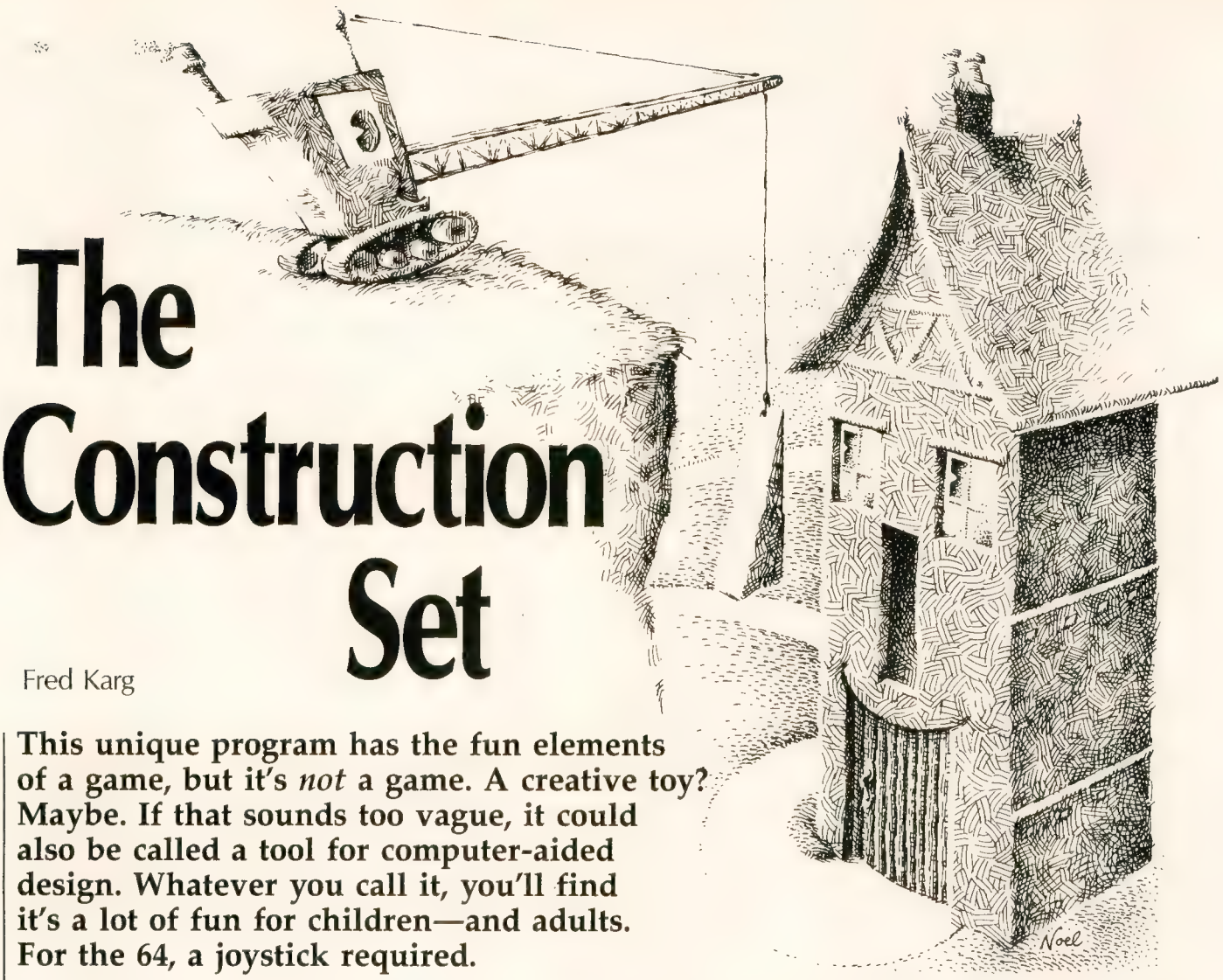
Another helpful source is "Power BASIC: Quick Character Transfer" (March 1985 GAZETTE). This program has versions for the 64, VIC, Plus/4, and 16.

If you choose the custom character set option with Banners, the menu will remind you to locate the custom character set at 12288 (for the 64) or 13312 (for the Plus/4 and 16). VIC users may use any safe location. In all versions, be sure to load the custom character set before loading and running Banners.

See program listings on page 151.

---

*These banners, created with a Commodore 64 and MPS-801, were significantly reduced in size so they could fit on a magazine page. Figure 1 was created with the uppercase/graphics option, a • character (SHIFT-Q), a height of 9 and width of 1. Figure 2 was created with the upper/lowercase option, a * (asterisk) character, a height of 2 and width of 2. Figure 3 uses the same options as figure 1, except the height is 3 and width is 2. The border figures are graphics heart characters (SHIFT-S). Figure 4 was created with the custom character option, graphics heart characters, and a height and width of 2.*



The Construction Set

Fred Karg

This unique program has the fun elements of a game, but it's *not* a game. A creative toy? Maybe. If that sounds too vague, it could also be called a tool for computer-aided design. Whatever you call it, you'll find it's a lot of fun for children—and adults. For the 64, a joystick required.

All our lives we build things, often just for the fun of it. Toddlers play with building blocks. Grade schoolers create elaborate structures with Tinker Toys, Lego blocks, and Erector sets. Teenagers put together model cars and planes. Adults have basement workshops for making things out of wood. Even the process of writing a computer program can be described as building something from parts.

"The Construction Set" is unlike most other computer programs. It can hold up to four different sets of building blocks which can be combined easily in any way you like. No one wins or loses and there's no high score. But it's great fun to create your own interesting picture.

Special Typing Instructions

The program listings include a BASIC program and three programs in MLX format. Type in Program 1 (The Construction Set Main Program) first. Datassette owners should change **DI=8** to **DI=1** in line 160.

The three MLX listings (Programs 2–4) are not machine language programs; they're character sets for three different sets of building blocks. Follow these directions to create each of the character sets:

1. Load but don't run the MLX entry program (found elsewhere in this issue). If you haven't used it before, be sure to read the directions carefully.

2. Enter **POKE 55,0: POKE 56, 64: CLR**.

3. Type RUN and answer the prompts:

Starting Address: 28672
Ending Address: 30723

4. Type in Program 2, 3, or 4. When you've finished, save the program.

5. Repeat these steps for each of the character sets you wish to use.

You don't have to type in all of the character sets, but you need at least one for The Construction Set to work properly.

Line 170 of the main program keeps track of how many character sets will be loaded and what their names are. Currently, it's set up for 3. If you enter only one or two sets of building blocks, change the 3 to a 2 or 1 and follow it with a comma and the name you used to save the character set file.

Tape users should be especially careful with line 170. Save all of the character sets to the same tape, one after another. Remember which one was saved first and make sure that filename is the first in line 170. For example, if you typed in and saved the first two sets, and saved them as HOUSE and MONSTERS, line 170 of the main program should read:

```
170 DATA 2,"HOUSE","MONSTERS"
```

Remember to modify line 160 as well.

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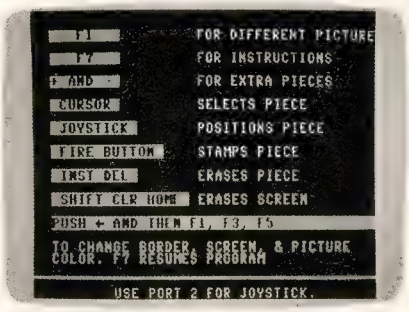
Putting Together A Picture

When you first load and run The Construction Set, you'll see the menu of commands on screen while the program loads the character sets.

Any time you want to check the menu, press f7 and the list of commands will appear (press f7 to go back to the work area).

The work screen is divided into two parts. At the bottom, you should see several building blocks. A pointing hand symbol floats above the blocks. Use the cursor keys (left and right) to move the hand back and forth to select the block you wish to place on the screen. Press the plus and minus keys to see more building blocks in the same set. Some blocks are full size, others are shorter.


f1 FOR DIFFERENT PICTURE
f7 FOR INSTRUCTIONS
+ AND - FOR EXTRA PIECES
CURSOR SELECTS PIECE
JOYSTICK POSITIONS PIECE
FIRE BUTTON STAMPS PIECE
INST DEL ERASES PIECE
SHIFT CLR HOME ERASES SCREEN
PUSH + AND THEN f1, f3, f5
TO CHANGE BORDER, SCREEN, & PICTURE COLOR. f7 RESUMES PROGRAM
USE PORT 2 FOR JOYSTICK.

Press f7 for the complete list of commands.

The top part of the screen is the work space. At first the screen is blank, except for a window (a hollow rectangle). With a joystick in port 2, move the window around the screen. Then press the joystick fire button to place a building block on the screen in the same position as the rectangle. To erase it, tap the INST/DEL key. Whichever block the hand is pointing to at the bottom of the screen is the one that's stamped on the screen.

The process of creating a design is fairly easy. First move to the set of blocks you want with the plus and minus keys, then use the cursor keys to move the hand to the pattern you want. After selecting a block, position the window and press the fire button. Patterns can be repeated as often as you like.

If you forget the commands, press f7 to see the menu. If you want to start over, clear the screen by pressing the shifted CLR/HOME key.

When you're finished, you can experiment with different colors for different parts of the screen. Press the left-arrow key (right above CTRL) and then one of the following keys.

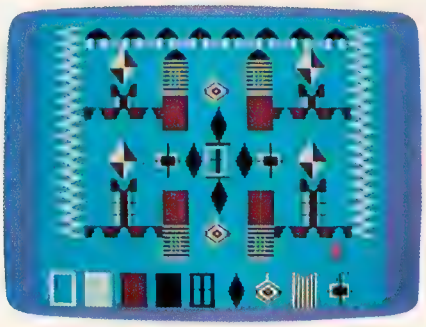
(←) f1: Change border color.
(←) f3: Change screen color.
(←) f5: Change character colors.

Four Character Sets, Four Screens

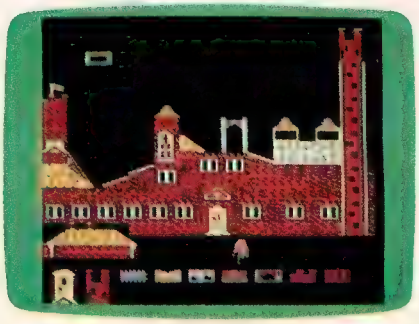
The Construction Set has room for four different character sets. Each defines a set of building blocks. The three accompanying the program are "House" for making brick buildings, "Creature" for putting together people (and monsters), and "Shapes" for abstract patterns. These custom character sets were created with "Ultrafont +" from the July 1984 GAZETTE. You can create your own Construction Set building blocks if you have a copy of Ultrafont +. You could invent building blocks for electronic circuits, quilts, landscapes, flags, or a variety of other patterns.

Each set of building blocks has its own screen. You can travel between the workspaces of each of the character sets by pressing f1 (as mentioned above, if you press the left-arrow key first, f1 changes the border color). The pictures you've created are preserved when you switch back and forth. So if you press f1 four times, you'll come back to the screen where you started and the picture will still be there.

People and monsters built from the Creature Character Set.



Diamonds, blocks, and zig-zags from the Shapes Character Set.



The House Character Set with its doors, windows, and walls.

An interesting modification for children is to load the same set of building blocks into all four workspaces. For example, you could change line 170 to **170 DATA 4, "CREATURE","CREATURE","CREATURE","CREATURE"** (tape users will have to use MLX to save the Creature font four times in a row on a single tape). Then have the child make up a story and build four pictures to illustrate the plot. When the characters have been put together, use f1 to step through the pictures as the child tells the story.

See program listings on page 152.

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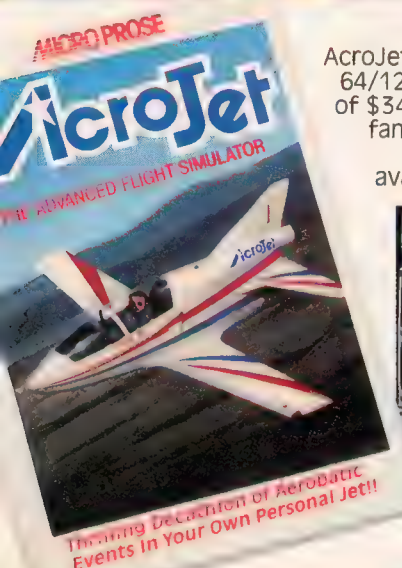

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SpeedCheck

An Expandable Spelling Checker For The Commodore 64 And 128

Ottis R. Cowper, Technical Editor

This easy-to-use program can help eliminate misspellings in your writing. It builds a personalized dictionary of the words you use most frequently. It works with all versions of *SpeedScript*, and with other word processors which store text in a similar format, including *WordPro* and *PaperClip*. For the Commodore 64 and 128 (in 64 mode); a disk drive is required.

Many commercial word processing programs include spelling checkers—programs that search for misspellings in documents created with the word processors. Since the initial debut of *SpeedScript* in January 1984, COMPUTE!'s GAZETTE has received hundreds of requests for a compatible spelling checker. Now there's "SpeedCheck."

SpeedCheck examines your documents word-by-word, comparing your typing with entries in its dictionary. What distinguishes this program from other spelling checkers is that it's *interactive*. You see your text on the screen as it's being checked. Words that aren't found in the dictionary are highlighted, so you can correct any misspellings immediately. SpeedCheck also highlights correctly spelled words if they aren't already in its dictionary. These new words can then be added with the touch of a single key.

Commercial spelling checkers come with prepared dictionary disks containing many thousand words. SpeedCheck can't match that—at least not at first. You start with a blank dictionary disk and add words as you go along. This means that SpeedCheck may be a bit tedious the first few times you use it, since you'll have to add many words. However, you'll soon build a customized dictionary disk that contains all the words you use most often.

The 664 available blocks on a blank dictionary disk provide room to add over 168,000 characters—enough, for example, for over 24,000 seven-letter words. *Note to* GAZETTE DISK *subscribers: The December* GAZETTE DISK *includes a SpeedCheck dictionary with nearly 2,000 words to help you get started. The disk menu includes a file with instructions on how to copy the dictionary to your own disk.*

Save Your Dictionaries

Let's clear up some common misconceptions about spelling checker programs before you discard your dictionaries and grammar books. Like most such programs, SpeedCheck can be deceived. If you type *form* when you mean *from*, SpeedCheck cannot detect the mistake if both words are in your dictionary. SpeedCheck makes no judgment about context; as far as it's concerned, *form* is a correctly spelled word. There's a way around this problem, though. If you frequently misspell *from* as *form*, just don't add *form* to the dictionary disk. Each instance of *form* will be flagged, because SpeedCheck won't find it on the disk, and you can check your use of the word *form*.

Many word processor users expect spelling checkers to magically improve the quality of their writing. However, programs that check grammar and syntax are enormously more complex than those that simply check spelling. A program that checked for good writing would approach artificial intelligence. While SpeedCheck can help you eliminate misspelled words, it can't make you a better writer.

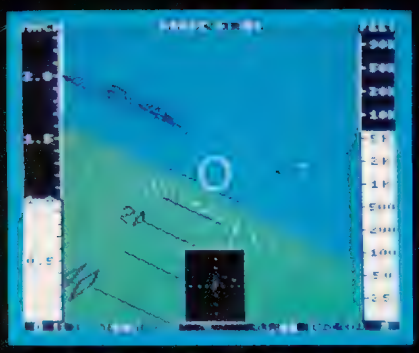
Also, remember that SpeedCheck is *not* a word processor. Although the program allows you to correct spellings and make minor changes, it's not suitable for major editing tasks. That's what your word processor is for. SpeedCheck works especially well with *SpeedScript 3.0*, the version published in the March 1985 issue of COMPUTE!.

If you have *SpeedScript 3.0*, you can exit the word processor and load SpeedCheck without losing the text in memory. You can also exit SpeedCheck and reload *SpeedScript* 3.0 without losing text. Most other compatible word processors—including *SpeedScript* versions 1.0 (COMPUTE!'s GAZETTE, January 1984) and 2.0 (GAZETTE DISK, May 1984)—clear the text area when run, so you must load the document to be checked into SpeedCheck, then save a corrected version after checking.

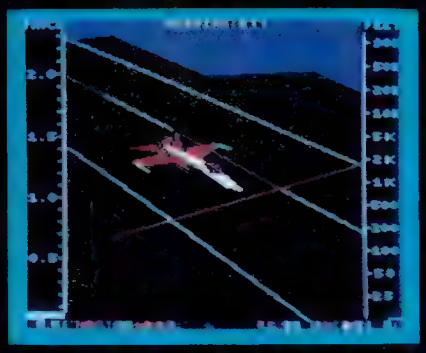
With minor modifications (explained below), SpeedCheck can also check documents from any word processor that stores characters in the same format as *SpeedScript*: as screen codes in program files. This includes the popular *WordPro 3 Plus/64* and *PaperClip* programs, but excludes those word processors that store text in sequential files, such as *Easy Script*.

For World-Class Misspellers

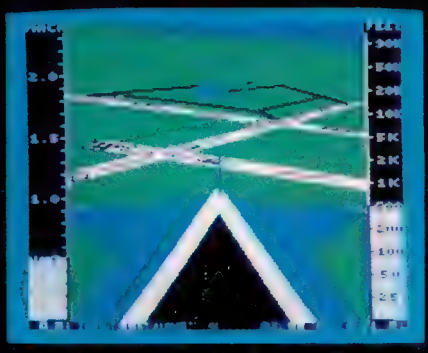
A price had to be paid to keep SpeedCheck short (it's only 2.6K) and simple, and to minimize the speed constraints of the 1541 disk drive. For one thing, SpeedCheck checks the spelling of only those words which have five or more characters, but this can easily be changed to any value you desire (more on this below).



F-16 Dogfight with Enemy MiG-23 Fighters



F-18 on the Deck of a Nimitz-Class Aircraft Carrier (Control Tower View)



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Five characters is an arbitrary limit, but it yields a good speed-versus-performance ratio. You can drop the limit to as few as two characters and check nearly every word in the document, but then it could take hours to check a long file. Unless you're a world-class misspeller, you'll always spell words like *a*, *an*, and *the* correctly; for most people, it's words like *triumvirate* that cause problems.

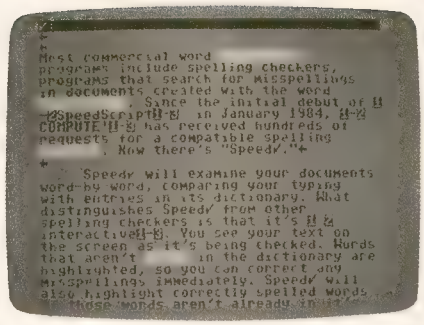
When counting characters in words, SpeedCheck recognizes only the letters A–Z and the apostrophe ('). Thus, contractions like *can't* are counted as five-letter words. The hyphen is not recognized, so a word like *left-handed* would be counted as two words, one of four letters and one of six. A letter's case (capital or lowercase) is not significant; all letters are converted to lowercase when looked up or added to the dictionary. Thus, a single dictionary entry would match *basic*, *BASIC*, and *Basic*.

Words in the SpeedCheck dictionary disk are kept in sequential files, with one file for each of the 26 possible initial letters. When new words are added, they are tacked onto the end of the files. This makes adding words fast and simple, but it makes looking up words slower because the words are in random—rather than alphabetical—order. Within the file for Z, for example, *zebra* might be found between *zymurgy* and *zipper*. The only way to find a particular item in randomly ordered data is to search sequentially from the first item until the desired item is found. Thus, when SpeedCheck looks up a word, it must hunt through all the words with the same initial letter before it can determine that the word is not present.

Nevertheless, SpeedCheck is faster than you might expect. The text for this article was checked in about 30 minutes using a dictionary disk containing about 2,000 words, including most of the words in the article.

Preparing The Program

Program 1 is a short BASIC program designed to manage the dictionary disk. Program 2 is SpeedCheck itself. Start by typing in and saving a copy of Program 1. This program allows you to create


Most commercial word
programs include spelling checkers,
programs that search for misspellings
in documents created with the word
. Since the initial debut of
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that aren't in the dictionary are
highlighted, so you can correct any
misspellings immediately. Speedy will
also highlight correctly spelled words

Words not found in the SpeedCheck dictionary are highlighted so you can correct any misspellings immediately, or add them to your dictionary.

dictionary disks and to review and edit entries in the dictionary. If you've decided to use a value other than five for the minimum number of characters for checking, you'll need to change the value of LN in line 110. The values you set here and in Program 2 should agree (see Customizing SpeedCheck below for details).

Your next step is to create a blank dictionary disk. Run Program 1 and select menu option 5. You're prompted for an ID for the disk. Enter any two characters, but be sure that each dictionary disk has a unique ID. Don't change the disk name in line 220; SpeedCheck tests to see that the dictionary disk has this name, and won't let you proceed otherwise.

It's a good idea to occasionally make backup copies of your dictionary disk. Because it takes hours to build up a large dictionary, and because the dictionary disk is subjected to an above-average amount of reading and writing, you need to protect yourself against potential data loss. Any backup program can be used—for example, "ReDisk" (August GAZETTE). Just be sure to give all backup disks the name DICTIONARY DISK.

After you've created a blank dictionary disk, it would be worthwhile to spend a few minutes entering a basic list of commonly used words. Use option 2 of Program 1. Any words that frequently give you problems should be entered at this time. You'll need to have a real dictionary (the book kind) handy to insure that the words you enter are spelled correctly. You can use options 1 or 4 of Program 1 to review your dictionary, and make any necessary corrections with option 3.

Now you're ready to use SpeedCheck. Since it's written entirely in machine language, the listing for SpeedCheck is in MLX format. Be sure you read and understand the instructions for using the MLX program, found elsewhere in this issue, before proceeding. Load and run MLX, and answer the prompts as follows:

Starting Address: 49152
Ending Address: 51821

Now enter Program 2 and save it on disk.

MLX puts the SpeedCheck data at 49152 for convenience; this avoids the nuisance of having to reconfigure memory. However, like *SpeedScript*, the finished SpeedCheck program can be loaded, run, and saved as if it were a BASIC program. (*Do not* add a ,1 after the ,8 in the LOAD statement when loading the finished SpeedCheck.) If you try to list the program, you'll see a single line of BASIC. To begin, simply load SpeedCheck (Program 2) and type RUN. If you're a *SpeedScript* user, the initial screen should be familiar. You'll see a blank screen with a blinking cursor and a reverse video command line at the top.

At this point, you'll have either one or two options. If the cursor is blinking in the same color as the command line, you must load text to begin, so press f7 to access the Load feature. No other key is active. If you had *SpeedScript 3.0* text in memory when you loaded SpeedCheck—or if you previously exited SpeedCheck with text in memory—then the cursor will be in the bright highlight color. In this case, you can either press RETURN to check the text already in memory, or you can press f7 to load new text.

If any errors occur during the load, an error message will be displayed on the command line. To erase the error message and try another Load, press any key. (In general, whenever SpeedCheck displays any message in the command line, it waits for a keypress before proceeding.) After the text is loaded, or after you press RETURN if there's already text in memory, you're prompted to remove your text disk and insert the dictionary disk.

After inserting the dictionary

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disk, press RETURN and SpeedCheck will begin to fill the screen with text. You'll probably see a number of highlighted words—words in reverse video and a different color from the text (not to be confused with *SpeedScript* formatting commands and printkeys, which also appear in reverse video, but in the same color as the text). These are the words that SpeedCheck did not find in its dictionary, so they may be misspelled. It's also possible that they are correctly spelled, but not yet in your dictionary.

Moving Around The Text Area

After the screen is filled, a cursor appears in the upper-left corner of the text, just below the command line. This is the home position for SpeedCheck. At this point, several more keys become active:

• RETURN: copies the word the cursor is on into the command line for editing or addition to the dictionary. (We'll call this "grabbing" the word; it will be discussed in more detail later.)

• Cursor left/right: behaves like the f1 and f2 keys in *SpeedScript*, moving the cursor left or right by whole words. When you're checking text, you can't move by a single character. The cursor should always stop on the first character of a word. It can be moved right one word at a time to the end of the document, with new lines scrolled in at the bottom as necessary. However, it can be moved left only as far as the home position of the current screen. You can't scroll backward in SpeedCheck, only forward.

• Cursor down/up: moves the cursor either down to the next line or up to the previous line. When moving up or down, the cursor shifts left or right to land on the first character of a word. The cursor can be moved down to the end of the document, with new lines scrolled in as necessary. However, it can be moved upward only as far as the home position of the current screen.

• CLR/HOME: moves the cursor to the home position. If the cursor is already home, pressing this key returns to the start of your document and rechecks the first screen of text.

• SHIFT–CLR/HOME: exits SpeedCheck. You'll be asked to verify this choice. Pressing Y exits to BASIC; any other key returns you to text. After exiting, you can type RUN again and reenter SpeedCheck without losing your text. The text will also be retained if you load and run *SpeedScript 3.0*.

• ↑ (up arrow): displays the next full screen of text. It's a bit faster than using cursor right or cursor down to scroll in one line at a time.

• SHIFT-↑: adds all highlighted words on the current screen to the dictionary before displaying the next full screen of text. This saves time when many words must be added to the dictionary, as when you're starting out with a new dictionary disk. You should be sure that all highlighted words on the screen are spelled correctly before using this feature. SHIFT-↑ has the same effect as ↑ if no highlighted words are on the screen.

• f1: searches forward in text for the next occurrence of a highlighted word and grabs the word into the command line. New screen lines are scrolled in if needed. The search can be cancelled by holding down the RETURN key until the cursor reappears. The search stops at the end of text if no highlighted word is found.

• f2 (SHIFT-f1): searches backwards in text for the last occurrence of a highlighted word and grabs the word into the command line. The search stops at the home position of the current screen if no highlighted word is found.

• f7: loads a new document from disk. Pressing RETURN alone at the filename prompt cancels the Load and returns you to text. SpeedCheck has no merge feature; a Load will overlay any text currently in memory. Load automatically appends the drive designation prefix 0:, so you should *not* include this when entering your filename. The check character (√) in the command line will disappear to indicate disk access. After the load is complete, you'll be prompted to insert the dictionary disk and press RETURN, after which the first screen of the new file will be checked. The cursor will return at the home position.

• f8 (SHIFT-f7): saves the text currently in memory to disk. Before the Save, you are prompted to remove the dictionary disk and press RETURN. Pressing any other key cancels the Save and returns you to text. (As with Load, Save can also be cancelled by pressing RETURN alone at the filename prompt.) The check character in the command line will disappear during the save to indicate disk access. After the Save, the cursor will be returned to its previous position in text. Save automatically appends the drive designation prefix 0: to the filename you enter, so you should *not* include this in the filename. This also precludes the use of the @ prefix for Save-with-Replace.

Command Line Editing

As mentioned earlier, SpeedCheck is not a word processor. You can move the cursor to a word in text, but you cannot directly edit it. To modify the word under the cursor, you must grab it into the command line by pressing RETURN (or searching with f1 or f2). Once the word and the cursor have moved to the command line, the following keys are active:

• All alphabetic, numeric, and punctuation keys.

• Cursor right/left: moves the cursor one character to the right or left, but not beyond the leftmost character of the word or more than one space beyond the rightmost.

• INST/DEL: allows you to insert spaces or delete characters within the word. When inserting, the total length of the word in the command line cannot exceed 32 characters.

• f3: adds the current contents of the command line to the dictionary. The word in the command line must be at least as long as the specified minimum word length or an error message will result. The word "added" will appear on the command line to let you know that the addition was successful. No check is made to determine if the word already exists in the dictionary before it is added. It doesn't hurt anything to have a word in the dictionary more than once; it just takes up extra space. However, it is important that you insure that

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words added to the dictionary are spelled correctly. You defeat the purpose of the program if you add misspelled words. You can use the editing feature (option 3) of Program 1 to remove duplicated words or correct misspelled words.

• f4 (SHIFT-f3): searches the dictionary for the current contents of the command line. The check character (√) in the command disappears when you press f4. If the word is found, the check mark reappears in normal command line color. However, if the word is not found the check comes back in the bright highlight color (it reverts to normal as soon as a key is pressed). This feature is especially useful after editing. For example, suppose the word *paralell* appeared highlighted in your text, so you grabbed it into the command line and corrected it to read *parallel*. You could then use f4 to determine whether *parallel* is already in the dictionary or needs to be added.

• f5: incorporates the current contents of the command line into text in place of the grabbed word. Any highlighting of the original word is removed. If the word hasn't been edited, no obvious change takes place other than the removal of highlighting. If the word returned is shorter, then all characters to the right on that screen line are pulled in to cover the extra space. If you lengthened the word, there will be a slight delay as the screen is reformatted to accommodate the extra characters. (The RETURN key also has the same effect as f5.)

• f6 (SHIFT-f5): clears the command line and returns the cursor to the text area without incorporating any changes and without removing any highlighting that may be present. It has the effect of "ungrabbing" the word.

You might start a typical SpeedCheck session by loading text, inserting the dictionary disk, and pressing RETURN. When the cursor appears, you press f1 to move to the first highlighted word. You find it spelled correctly, so you press f3 to add it to the dictionary, then f5 to return to text, then f1 to find the next highlighted word. You notice that this word is misspelled, so you correct it, press f4 and discover that the corrected version is already in the dictionary, then press f5 to incorporate the correction into the text.

Then you notice a place where you used *their* when you meant *there*. SpeedCheck didn't catch the mistake, since both words are in its dictionary, but you can correct it simply enough. Use the cursor keys to move the cursor to the word, press RETURN to grab it into the buffer, change the spelling, then press RETURN again to incorporate the change. As you become comfortable with SpeedCheck's commands, you'll find that you can move quickly and smoothly from key to key as your document is checked.

Customizing SpeedCheck

It's easy to change the value for the minimum number of characters a word must have to be added or looked up. Just load SpeedCheck and POKE the desired value into location 2083. PRINT PEEK(2083) will show that the current value is 5. To change it, say, to a value of 4, type POKE 2083,4. If you save a copy of SpeedCheck after changing the value in 2083, your new value will be incorporated into SpeedCheck. Do not drop the limit below two characters.

You can use one minimum length value for a while and then change to another without having to create a new dictionary disk. But consider that if you use a four-character limit extensively and then switch to a five-character limit, you'll have many four-character words in the dictionary that the new version will never use. Likewise, if you use a five-character limit extensively, then switch to a four-character limit, searching will be slowed because all four-character words will start far into the dictionary.

If you'd prefer other colors for text, background, or highlighting, they're easily changed. The following locations hold color values:

2079 Background color
2080 Text color
2081 Highlight color

Simply POKE the appropriate location with the standard Commodore code (0–15) for the desired color. The only restriction is that the color you choose for highlighting (location 2081) must be different from the text color (2080). If you're not satisfied with your new choices, exit SpeedCheck and try again. If you save a new copy of SpeedCheck, your color changes will be incorporated.

SpeedScript doesn't waste any text memory. The spaces you see at the ends of lines and following return marks are not stored in memory. This is not the case with all word processors. Some, including *WordPro* and *PaperClip*, include within text all the spaces shown at the ends of lines. To use SpeedCheck with these word processors, you must defeat SpeedCheck's handling of the *SpeedScript* return mark (←) character. To create a version for *WordPro* and similar processors, substitute the following line while entering Program 2 with MLX:

```
50796 :234,234,144,197,032,155,080
```

When you use this version, text will look a bit different from what you may be accustomed to—there will be many extra spaces and words are no longer split at the right screen margin. Nevertheless, SpeedCheck should perform normally, and you can use the same dictionary disks you use with the *SpeedScript* version.

One additional change is required to create a version for *PaperClip* files. Since that program stores text slightly differently from the other two word processors, you must modify the Load routine a bit. Substitute the following lines when entering Program 2 with MLX:

```
51240 :003,166,174,164,175,032,242
51324 :198,255,169,194,133,174,223
51330 :169,196,133,003,169,035,067
51336 :133,175,133,004,169,000,238
51342 :133,176,169,036,133,177,198
```

If you're using a 1541-compatible dual-drive unit (drive numbers 0 and 1) with your 64, it's simple to modify SpeedCheck to use both drives. Load SpeedCheck, but don't run it. Enter the following line in immediate mode:

```
POKE 4700,49:POKE 4707,49
```

Then save a copy of the modified program. This new version requires that the text disk be in drive 0 and the dictionary disk in drive 1. When using the Save command, you'll still get the prompt to remove the dictionary disk. Simply ignore this prompt and press RETURN.

See program listings on page 157.

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List Pager

Robert A. Stoerrle

If you own a printer, you'll appreciate this short utility. It allows you to divide printouts into pages, insert headers, and print page numbers. For the Commodore 64 and VIC-20.

No matter how much you adjust the paper on a printer, it seems that one line always prints smack dab on the perforation. When you separate the pages, the line is cut in half. Some printers have a "skip-over-perf" or *paging* option, accessed by setting a DIP switch or sending an escape code. On the 1526 or MPS-802, for example, you turn paging on with PRINT#4, CHR$(147).

But this important feature is missing from the Commodore 1525, MPS-801, and MPS-803 printers. "List Pager" is a short machine language utility that offers a solution to the problem. It causes the printer to automatically skip to the top of the next page when it runs out of room on the current page. And it will print both a header at the top of each page and the page number, if you want. Even if your printer already skips over perforations, you'll find the header and page numbering options useful.

Special Loading Instructions

Type in and save the List Pager loader program, which uses a special technique to store the machine language (ML) program in a string variable. The ML has to be saved to tape or disk as an object file (a pure machine language program) before you can activate it.

After running the program, you're asked if you wish to save it to tape (T) or disk (D). If you press D, you're prompted for a filename. If you're saving it to the same disk as the loader program, be sure to use a different program name. After you give it a name, the machine language portion of the program is saved to disk. If you're using tape, be sure to have a blank tape in the Datassette, preferably positioned to the beginning. Press T and the computer will prompt you to press RECORD and PLAY (tape users don't name the program because the ML string becomes the name of the file).

To load the ML program from disk, type:

```
LOAD "filename",8,1: POKE56,PEEK(56)-1:NEW
```

The first time you load it from tape, type this line:

```
OPEN 1:CLOSE 1:POKE 56,PEEK(56)-1:CLR
```

In both cases, you should be loading the *object file* that was created, not the loader program you typed in. Besides loading the program, these procedures clear all variables.

Protecting The Cassette Buffer

The cassette buffer is a section of memory that acts as a sort of pipeline between the cassette drive and the computer. It's a safe place to store ML programs on the VIC-20 because memory expansion changes the layout of BASIC memory. You can't count on any part of the VIC's BASIC memory to be available for a machine language program, so the cassette buffer is often the best place for ML. This program works on both the 64 and VIC (unexpanded or expanded).

Solving the problem of VIC memory expansion creates a problem for tape users. If the List Pager ML is in the cassette buffer when a program is loaded, it will be overwritten because the data on tape is temporarily stored in the buffer. So, VIC and 64 tape users will have to take measures to protect the cassette buffer while using List Pager.

Tape users should *never* access tape files while List Pager is active. Before loading, saving, or opening, press RUN/STOP-RESTORE to turn off List Pager. After you load or save a program, List Pager will be gone, overwritten by the program data. To load it back in, put the cassette containing the ML part (the object code) of List Pager into the Datassette and enter **OPEN1:CLOSE1** (you should not enter the POKE to 56 unless this is the first time you're loading List Pager). The program is built into the tape file header and will load directly into the cassette buffer. You'll have to enter the SYS below to start it up.

The order of loading programs is just the opposite for disk owners. Tape users load the program to be listed first and then load List Pager (because of the cassette buffer). With a disk drive, you must load List Pager first (because of the NEW instruction after the LOAD and POKE). Once it's loaded, you can load the program or programs to be listed. Disk owners need to load the ML only once; disk access doesn't affect the cassette buffer.

Telling It What To Print

Once List Pager is loaded, following the instructions above, you must activate it and tell it what to do at the top of each page. The format for this command is:

```
SYS 833,"Header"
```

If you want a header at the top of each page, put it between quotes. If you want the page number to be printed, insert a number sign (#) into the header at the point where you want it to be printed. For example:

```
SYS 833,"LIST PAGER.....PAGE #"
```

The designated header will be printed at the top of each page. Pages will be numbered consecutively, starting at page one. If you do not want a header at the top of each page, do not put anything between the quotes:

```
SYS 833,""
```

You must *always* use a comma

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and quotes, even if you do not wish to print a header.

After entering the header line, position the paper so that the print head will start printing a few lines down to allow for a top margin. If you've not already done so, load the program you wish to list (remember, tape users should load the program to be listed before loading List Pager). Type the following line:

```
OPEN 1,4:CMD 1:LIST
```

The printer should print the header, if you specified one, and start to list the program. When it's finished, type:

```
PRINT #1:CLOSE 1
```

List Pager will remain in effect until you press RUN/STOP–RESTORE. That is, it will continue to separate pages and print the header at the top of each page.

Options

The program is written for standard 8½ × 11 inch paper, with six lines per inch, a total of 66 lines on each page. If you're using nonstandard paper, you can modify the parameters. Some European countries, for example, use slightly longer paper. The program defaults to 54 printed lines on a page of 66 lines. This leaves two lines for the header (one printed, one blank) and ten lines between pages (five at the top, five at the bottom).

After the program has been loaded, you can change the number of printed lines per page with a POKE:

```
POKE 926,x+4
```

where x is the desired number of printed lines per page. For example, if you wish to print 38 lines per page, you would type **POKE 926, 38+4** after the program is loaded (but before you enter the SYS). The default number of printed lines per page is 54.

To change the total number of lines per page (printed and unprinted):

```
POKE 934,x
```

where x is the number of lines per page. The default number is 66.

Not Just For Program Listings

List Pager is designed to work with every printer, whether dot-matrix or letter-quality. However, it will work only with a printer with a device number of four. Also, it will not affect listings on the screen. It can be used for a variety of purposes, not just program listings. For example, you can use it within BASIC programs to divide output into pages.

List Pager works by inserting a "wedge" into the routine that the computer uses to print a character. Every time the computer wants to print a character, it goes to the wedge program first. If the character is a carriage return, and the computer is at the bottom margin of a page, it skips to the next page and prints the header. If the character is not a carriage return, it's sent to the normal print routine.

To make List Pager work on both the 64 and VIC (expanded or not), the cassette buffer was used to hold the program. Because of this, some conflicts may arise. Using the cassette drive while this routine is in effect will usually cause the system to lock up. In addition, other programs which reside in the cassette buffer, such as "The Automatic Proofreader," cannot be used at the same time as List Pager.

See program listing on page 144.

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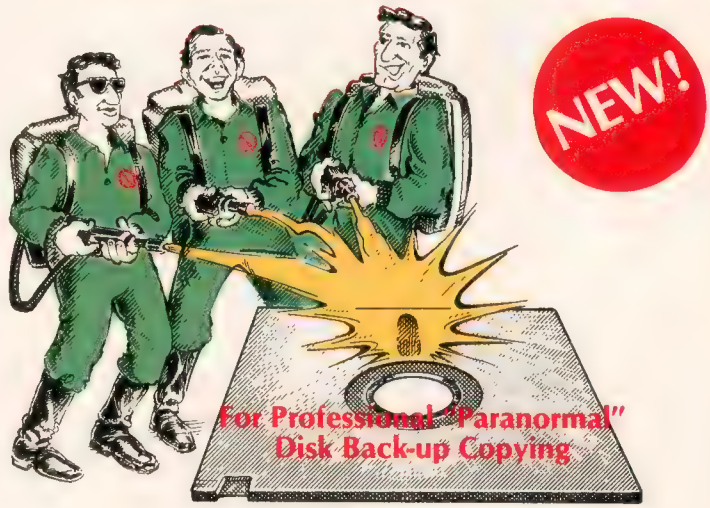

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Variable Saver

G. Russ Davies

Here's a technique for automatically saving variables with your program. The next time you load the program, a few POKEs bring all the variables back. Also included as an example is a short household budgeting program. For the VIC and 64.

Two methods are commonly used for handling large amounts of data in BASIC programs. The first method, using DATA statements, reads information into a program. But changing the DATA statements means listing the program and typing new data. It's not the best way to handle information that changes often. Data files, the second method, are the next step up. First you open a file on tape or disk and then print the information out. To retrieve it, open the file and read the information back in. But it takes time to read and write files.

If you've ever wanted to load a program and have the variables instantly ready, here's a technique you can use. After a few PEEKs and POKEs, you have immediate access to variables.

An Easy Filing System

Saving variables with a program provides an easy data filing system since the data is located with the program, not on another tape or disk. For the nonprogrammer, this integration of the program and variable data can substantially simplify program operation. Since program-calculated variables are reloaded, results of the previous run can easily change the way the current run is to be performed without adding more complicated file input/output processing or "dynamic keyboard" techniques.

Also, the fact that variables are saved with a program can be used to provide a store/restore facility—allowing you to interrupt your work, save the state of the program and variables, then later restore the saved version and continue on with your work. The technique is not meant to replace DATA statements, "dynamic keyboard," or input/output files, but is an alternative tool you'll find useful in certain situations.

Where Variables Reside

Variables are stored at the end of the BASIC program in the Commodore 64 and VIC-20. These variables are separated by type (scalar, array, and strings) with pointers used to mark the beginning and ending locations of each type of variable "pool." Pointers also keep track of the beginning and ending locations of the BASIC program.

The pointers which mark the locations of the BASIC program and variable pools are kept in one area of memory—from locations 43 to 56:

43–44	beginning of the BASIC program
45–46	end of the program, beginning of the scalar variables
47–48	end of scalar variables, beginning of the array variables
49–50	end of the array variables, beginning of free RAM (with room for more variables as they are created)
51–52	end of free memory, bottom of string variables
55–56	end of the string variables

If a 64 BASIC program is 4000 bytes long, it would start at 2049 and end at 6049. The pointers at 43–44 and 45–46 would contain these two numbers. If nonarray variables took up another 2000 bytes, locations 47–48 would point to 8049, and so on. When you type SAVE, the computer uses the pointers to the BASIC program to figure out where the program is. Variables are not saved.

But, we can fool the computer into thinking the program is longer than it really is by changing the values in locations 45 and 46. If the pointer to the end of the program is changed to reflect the end of the variables, the variables will be saved along with the program.

We must also save the pointers that are used to mark the beginning and end of each type of variable pool, or the variables will be unusable. Since the free area of unused memory is located between these variable pools, the amount of time and space required to save the program variables can be reduced by limiting the free area to only the amount needed by the program.

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>WRAP THE TOWEL AROUND MY HEAD

And the story responds:

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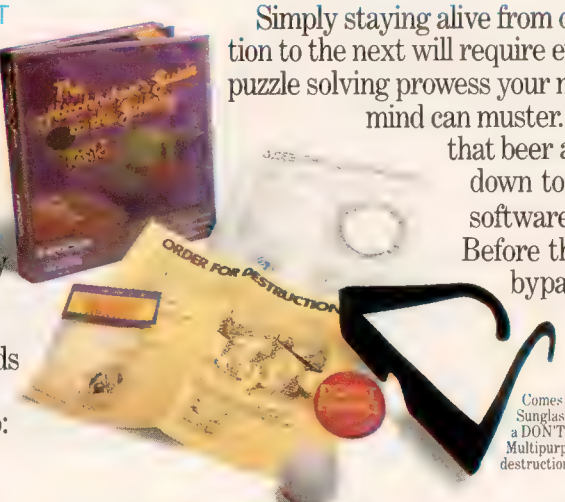

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by eight π symbols (type SHIFT up-arrow to display the π symbol) in line 100 of the program reserves eight bytes in which to save the variable pool pointers. By using the first program statement for this purpose, the saved variable pointers can easily be located by adding seven to the contents of the pointer in 43–44.

Be sure to squeeze the eight π symbols up next to the quotation mark following the REM (don't put a space between them). The π symbol is used because its ASCII code of 255 is not a possible value in the second position of variable pool pointers, so we can instantly determine if pointers have been saved into line 100. Line 150 checks the second position of the first saved pointer and branches to the variable initialization routine if no pointers to variables have been saved by a previous run. When variable pointers are stored into line 100, listing that line may cause some strange characters to be displayed, but the rest of the program will list and run correctly.

To cause the program to *ignore* any previously saved variables, the program and variables are loaded into a different sized VIC-20, the same amount of memory expansion is required when loading programs as was used when saving. The 64 needn't be restricted.

The Home Budget Program

To illustrate this technique, I've included a simple budgeting program that keeps track of income and bills.

Since you can change the description of all categories and the amounts budgeted to the categories, this program is a natural candidate for the variable saving technique. The user may progressively modify and refine the budget. Monthly final versions may also be kept for household records. Each month's budget can then use a previous month as a beginning model.

The program works on the 64 and any expanded VIC-20. Notice the indicated changes for the VIC-20 that are included in REM statements. The item descriptions for the 64 may be extended to 27 characters by using the program prompts.

The REM statement followed

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amount of variable storage available to BASIC. Line 480 tells you (when finished with the program) to SYS to the power-up routine that will reset the BASIC pointers to the normal configuration.

If you decide to save the variables with the program, lines 510–560 will save the variable pointers into line 100 and change the end-of-program pointer to include the variable pools.

You can now save the program and current variables on tape or disk. The next time the saved program is used, the calculated and user-modified variables will be "remembered."

If you use this technique in your own programs, keep a few things in mind. You have to save the pointers before altering them; the most convenient place is in a REM statement at the beginning of the program. And when the program with the saved variables is loaded, you can't use any variables until you restore the pointers. Finally, the program must be resaved after you finish working with and changing variables.

See program listing on page 144.

load and run the program, press the STOP key, change line 100 to contain a π character in the second position after the REM", and then run the program again. You'll probably want to keep a copy of the program without saved variables for a master copy.

Lines 170–200 reestablish the saved variable pool pointers. Notice that variable names cannot be used until after the pointer in 45–46 has been restored by lines 170–180; then a loop can be used to restore the remaining three pointers.

Line 210 insures that only 1024 bytes of variable storage space are allocated. The minimum amount is determined by estimation with FRE. Reducing the variable storage space will significantly speed the saving and loading of saved variables since the vast empty free memory area isn't included. The variable pool size is similarly restricted in line 580 to initialize the variables the first time the program is run. Line 210 then causes first-time variable initialization to be skipped since saved variables are being used.

Note that we have reduced the

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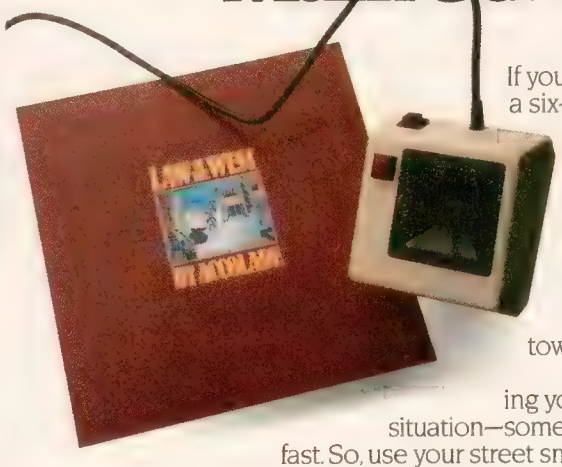

If you've ever wanted to strap on a six-shooter, pin a tin star to your chest and match the exploits of Bat Masterson or Wyatt Earp, then Law of the West is your chance. Forget about gunning down Main Street in your Porsche. It's the 1870's and you're the Sheriff of Gold Gulch—as bad a Wild West town as there ever was.

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If you've discovered a clever time-saving technique or a brief but effective programming shortcut, send it to "Hints & Tips," c/o COMPUTE's GAZETTE. *If we use it, we'll pay you $35.*

Load From The Disk Directory

M. Albani

One of the first things new owners of disk drives learn is how to load and list the directory (**LOAD"$",8** followed by **LIST**). On the 128 and Plus/4, you can use the built-in DIRECTORY command or the corresponding function key. The number of blocks used by each program appears on the left, then the filename in quotation marks, and the type of file. On the 128, 64, and VIC, holding down the CTRL key slows the listing. The Plus/4 and 16 use the Commodore key for a similar effect.

When you see the program you want, stop the listing by pressing the RUN/STOP key. If the file is named "QWERTY", you can type **LOAD "QWERTY",8** or **LOAD "QWERTY",8,1** if it's a machine language (ML) program.

But there are a couple of easier ways. While the directory is still on the screen, you can move the cursor to the line containing the program name. Type **LOAD** and cursor right to the space just past the second quotation mark. Add **,8:** and press RETURN. If you forget the colon, the computer thinks PRG is part of the LOAD command and returns an error message. Curiously, you don't need the colon if you're loading an ML program with **,8,1**.

This method of loading from the directory saves some typing, but there's an even better way—you build the ,8: or ,8,1 into the program name. When you save a BASIC program, use this format:

```
SAVE"PROGRAMNAME
{SHIFT-SPACE}{D}8@",8
```

When you load and list the directory, you'll find the SHIFT-SPACE (entered by holding down SHIFT and pressing the space bar) has turned into a quotation mark, the Commodore-D is a comma, the 8 remains an 8, and the SHIFT-@ is a colon. Now you can load the program very quickly: load and list the directory, cursor to the program you want, and enter either LOAD or L SHIFT-O, the abbreviation for LOAD. If you're using MLX or have another way to save ML programs (see below), you can use a similar syntax for ML files:

```
SAVE"PROGRAMNAME
{SHIFT-SPACE}{D}8{D}1",8
```

Remember that filenames must be 16 characters or less, including the graphics characters and shifted space. If you want to add the ,8: to an existing program, use the rename command: **OPEN 15,8,15, "R: newname=oldname"**, with the SHIFT-SPACE and graphics characters in the new name.

After you've created the **,8:** or **,8,1** suffix, you need to press just three keys to load a program from the menu: L, SHIFT-O, and RETURN.

A Library Of Subroutines On Tape Or Disk

Michael Dean

At one time or another, every programmer has wished for a way to append subroutines to a program. Many such routines, like the MERGE command from "Meta-BASIC," work only with a disk drive.

With a few PEEKs and POKEs, you can append one program to another on the 64, Plus/4, 16, and VIC using either a Datassette or a disk drive. This technique won't work on the 128 in 128 mode because variables are stored in a separate bank of memory. Also, the 128's memory locations are used in a different way.

First, load the main program. Then add these lines to the beginning:

```
1 PRINTPEEK(43),PEEK(44)
2 SV=PEEK(45)+256*PEEK(46)-2
3 POKE43,SVAND255:POKE44,SV/25
  6:NEW
```

Write down the two numbers you see on the screen; they're pointers to the start of BASIC. On a 64, you should see a one and an eight, unless you've moved the beginning of BASIC for some reason. Don't worry about the NEW command in line 3, it won't erase the main program from memory. Now load the second program, the subroutine to be added to the end of the main program.

Now, take the two numbers—the pointers that were printed to the screen—and POKE them back into 43 and 44. If they were one and eight, you would type **POKE 43,1 :POKE 44,8**. Listing the program should show that the second program has been appended to the first. You can run this routine several times to append several programs.

There's one important thing to note: The line numbers in the second program should be higher than the highest number in the first. This method of appending programs does not renumber the lines.

If you keep good records, you could build up a library of general-purpose subroutines, starting at a relatively high line number like 40000 (the highest possible line number is 63999). You might number a joystick reading routine 40000–40052, a hi-res graphics routine with lines 40100–40277, and so on. Keep notes on how each routine works and which variables are used.

Then, when you write a program, append the appropriate subroutine from the library. The programs in the library could be short and simple—a few lines that read the disk error channel—or

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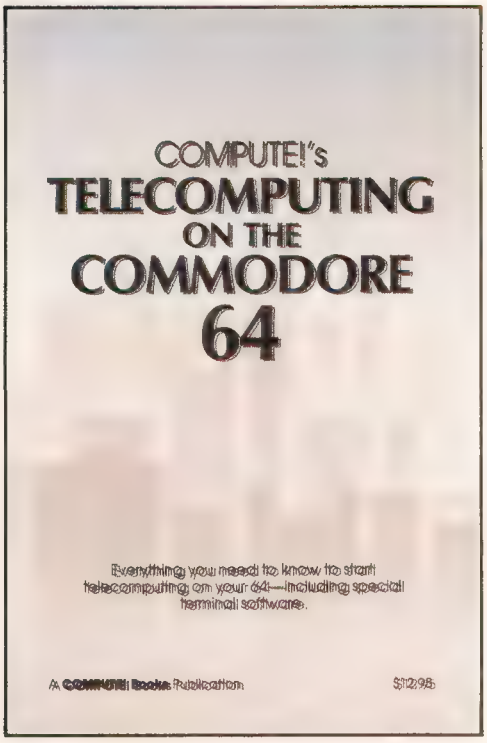

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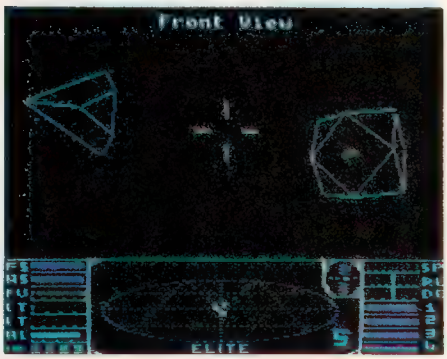

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For those curious about what the POKEs do, here's a brief explanation. Locations 43–44 point to the beginning of the BASIC program, and locations 45–46 keep track of the start of variables (SV in line 2). Two zeros separate the last byte of a program from the first variable. So, by PEEKing 45 and 46, converting the pointer to a regular decimal number, and subtracting two, we can find where the next line should be added. Next, line 3 figures out the high byte and low byte of SV, the previous start of variables minus two, and moves the start of BASIC up. Now, you just load the program to be appended, POKE 43 and 44 with their normal values, and the task is accomplished. You must load from immediate mode, because of the way the pointers are handled. You can't load from within the program.

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Lawrence Cotton

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The picture of the sound appears only seconds after you hear it. As many as three different sounds may be drawn side by side, so that they may be compared. The data that determines their shape is simultaneously displayed.

Sight And Sound

Save the program to disk or tape after typing it in, then run it. You'll next see a series of questions to which you should respond, for now, 33, 172, 56, 60, and 20. Press RETURN after each entry.

After a short pause, you'll hear a sound and see two graphs being drawn. The cyan graph on the left represents the waveform. There are four available waveforms on the 64: *triangle*, *sawtooth*, *square*, or *noise*. On the right, the yellow graph shows the sound's *attack*, *decay*, *sustain*, and *release*—the envelope. These are actual plots of values generated in two memory registers while the sound was playing. To display the graphs, I've used eight sprites, four for the waveform and four for the envelope.

What do they mean? Let's take the waveform first, since it's the easiest to understand. When you typed 33 for the waveform number, Soundpix POKEd it into control register 54290, which turned on, or *gated*, voice three's *sawtooth* waveform. Now you can *see* how sawtooth got its name. (The right sides of the graphs are the lowest values.) The character, or *timbre*, of a sound is directly related to the shape of its waveform.

After the graphs have been drawn, type C for Compare. This time enter 65 (for a square waveform) instead of 33 (sawtooth). The program will ask for the *pulse width*, so enter 8. (Pulse width is used only with the square wave.) Respond to the rest of the questions with the same numbers as you did in the first series.

Register 54290 is then POKEd with the 65, initiating the more mellow sound of the square wave, which should now be accompanied by a matching square wave graph. This 8 value insures that the wave

Soundpix offers a sight and sound demonstration, and it lets you compare sounds, as shown in this example.

is truly square; the ratio of cyan to black on the graph is about equal. If you type different values from 1 to 15, you'll get different percentages of cyan and black (and different sounds).

Be sure to listen to the triangle (17) and noise (129) waveforms also. The triangle waveform creates the smoothest sound and the smoothest graph or curve. And noise is created by random values—the waveform is anything but regular and smooth.

The Envelope

The *envelope* of a sound is its amplitude or loudness throughout its life. Run the program again, listen to the example sound, and look at the right-hand graph. Notice how the loudness of the sound follows the shape of the graph as it moves from top to bottom. Again, the right side of the graph reflects the lowest values (the quietest parts of the sound).

The rise in volume at the top of the curve is called the *attack*, which

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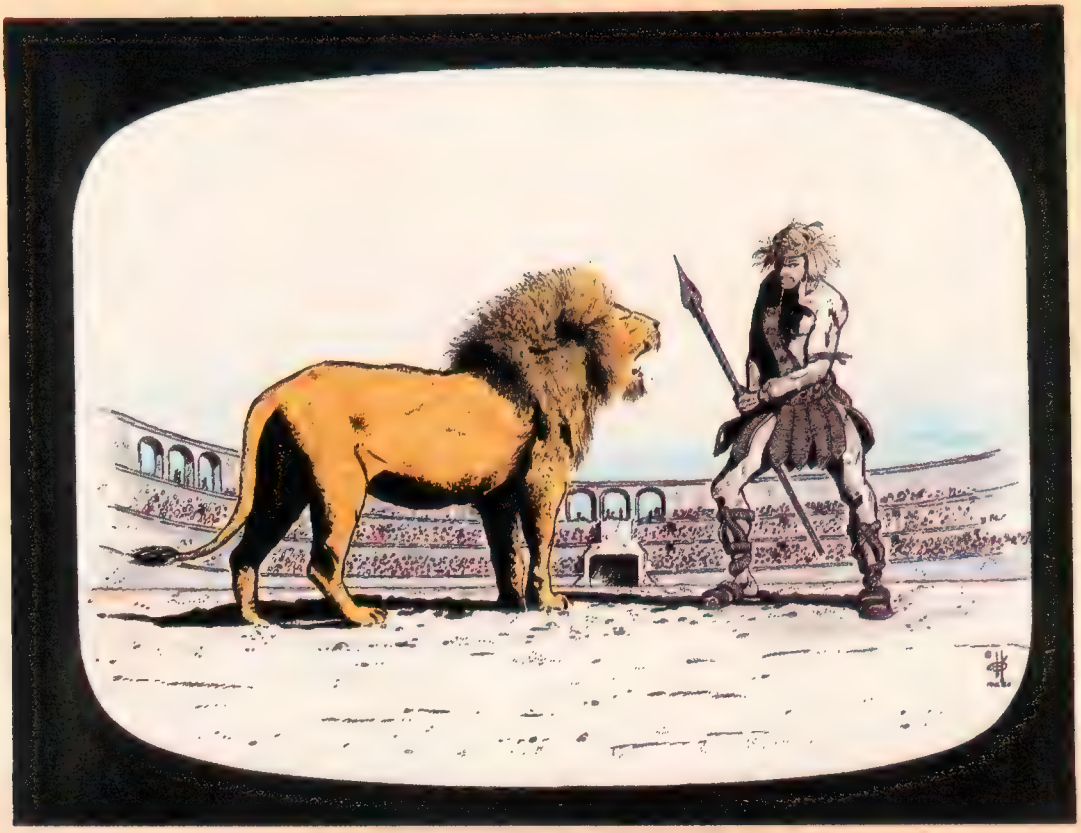

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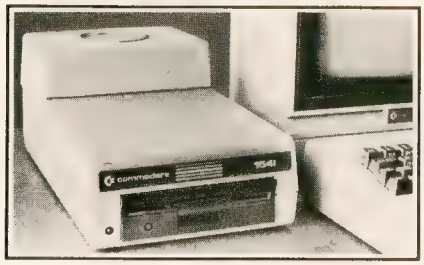

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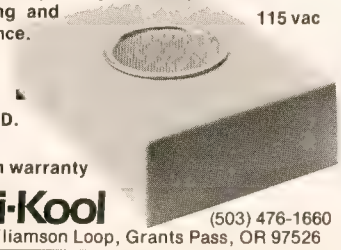

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starts as soon as the voice is turned on. The next part of the sound's lifetime is called *decay*. The second number you typed controls the attack and decay. The sound decays from its highest attack level to the *sustain* level, which is the middle portion of the curve.

Last is the *release* portion of the curve. It starts when register 54290 is turned off, and is the last (or bottom) part of the curve. The third number you typed controls the sustain and release portions.

The sustain and release times (fourth and fifth numbers) also influence the final shape of the ADSR (attack/decay/sustain/release) curve; these are simply FOR-NEXT loops which create delays—one for voice-on time, one for voice-off time.

In any envelope, the sustain time actually starts as soon as the voice register is gated. Thus, it's entirely possible for one part of the curve to "override" and obliterate another. Sometimes the decay is so long that the release portion of the curve starts before the sustain time is completed; the curves will seem not to match the sound in these cases.

The waveforms normally generated on the Commodore 64 are triangle (17), sawtooth (33), square (65), and noise (129), but you may type in any number between 1 and 255 (23 and 85 are also interesting). For the attack/decay and sustain/release values, you may type any numbers from 1–255. However, the sustain and release times *must* add to 84 or less. The program will check for these values.

Program Description

By studying the program listing, you can learn more about how to program sound on the 64.

Lines 10–30 set up the screen and define constants and variables.

Line 40 clears the sound chip, and POKEs a 143 to 54296 for maximum volume and to turn off voice three's audio. (You're actually hearing voice one, which is POKEd with the same values that go to voice three.)

Lines 50 through 80 set up the eight sprite pointers and locate the sprites.

Line 90 paints the first four sprites cyan and the second four yellow. Line 100 expands them all horizontally.

Line 110 POKEs frequencies to voices one and three (voice one's is higher).

Lines 120–230 gather input and check it for validity in a subroutine at line 560.

Line 240 POKEs the input envelope values to voices one and three.

Line 250 POKEs the pulse width (for use with square wave only) and turns the voices and sprites on.

Lines 260–270, a key part of the program, fill two arrays—for waveform and envelope—with values throughout the sound's life. These values are read from two of SID's registers, 54299 and 54300. Register 54299 reflects the character of voice three's *waveform* and 54300 reads the output of voice three's *envelope* generator. The character of the numbers generated is directly related to the waveform and envelope specified.

If the sustain and release time do not add to at least 84, line 280 fills the rest of the arrays with zeroes.

Lines 290–310 print the screen.

Lines 320–390 draw the graphs, filling them up by thirds, depending on the starting value of Q (initially 12288).

Lines 400–440 print appropriate messages under the graphs, depending on whether they're filled or not.

Lines 450–500 wait for and react to the user's response. If the erase response is selected, the program is RUN from the beginning. If quit is selected, the program ends with a normal screen. If C (for compare) is pressed and the graphs are not full, the beginning address for the next incoming sprite data is defined and the cursor position is incremented so that the input information is displayed sequentially.

Lines 510 and 520 are subroutines for POKEing the two arrays' values to the sprite data registers, thus "drawing" the graphs.

Lines 530–550 are the subroutine to assign a pulse width when the square wave is selected.

Lines 560–580 check for validity of input data.

See program listing on page 143.

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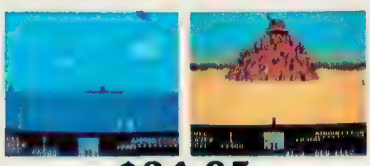

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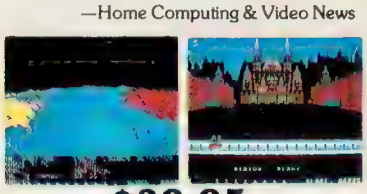

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Disk File Archiver

Keith Lossett

Have you ever listed your directory and wondered which is the latest version of that program you've been writing? This short machine language program can help. For the Commodore 64.

Anyone who programs on the 64 and has disk files with names like PROG.3, XYZ BACKUP, or TEMP37, will find "Disk File Archiver" a useful utility. It's a short machine language program that eliminates the need to choose a unique filename or use the undependable Save-with-Replace command when you make program revisions.

With Archiver safely hidden away in memory, you can always save the latest revision with the same filename.

For example, let's say you begin writing a program which you save with a filename of "BUDGET". After saving, you decide to make modifications, additions, or do some debugging. You can't save the new version as "BUDGET" because there's already a file with that name. Normally, you'd have to scratch the previous file, rename it, or think of a new name like "NEW-BUDGET" for the latest file.

But Archiver simplifies things. Say you saved the original program with the name "BUDGET". After making revisions, you save your next version with the same filename, "BUDGET", and Archiver saves it with this filename. The original version is automatically renamed "BUDGET.1". If this process is repeated, the original version becomes "BUDGET.2", the previous version becomes "BUDGET.1", and the current version becomes "BUDGET".

Archiver saves up to five versions of a program. Here's how it works:

BUDGET—the most recent version of the program

BUDGET.1—the previous version

BUDGET.2—the version before BUDGET.1

BUDGET.3—the version before BUDGET.2

BUDGET.4—the version before BUDGET.3

Archiver keeps only the current version of a program and its four predecessors. So if you have six versions of BUDGET, the oldest version is gone. Or say you've saved ten versions of BUDGET before deciding that you're satisfied with the results. If you list your directory, you'll see the five most recent versions.

Typing It In

Archiver is written entirely in machine language and is listed in MLX format, found elsewhere in this issue. After loading and running MLX, enter the following when prompted:

Starting Address: 49152
Ending Address: 49577

Type in Archiver and save a copy. To use the program, load it and type RUN (there's no need to SYS). Be sure to leave your disk drive on after loading Archiver. Also, note that when the program is run, the system appears to reset as if you just switched on the computer. The usual COMMODORE 64 BASIC V2 message appears, but you'll notice that the number of bytes free is less than the usual 38911. One final note: Do *not* specify a drive number (SAVE "0:*filename*",8). Archiver adds the *0:* automatically.

See program listing on page 143.

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Educational Software that Works

Auto Time And Date

David Archibald

If you program with a 64 and disk drive, this handy utility can prevent confusion over which is the most current version of a program. It marks each program with the date and time, like an automatic rubber stamp.

When writing a BASIC program, I usually have several different versions of it on disk. It's easy to forget which one is the latest version. Some computers—like the IBM PC— automatically record the time and date when a program is saved. You can tell at a glance which copy is the latest version.

"Auto Time And Date" provides a similar feature for the Commodore 64. It automatically puts the current date and time into the first line of a BASIC program.

REM Time

For this program to work, the first line in your program must be a REM statement. You must then follow the REM with at least 18 characters. It doesn't matter which letters you use because they're going to be replaced with the date and time. If you enter more than 18 characters, they'll automatically be deleted.

Should you forget to include a REM statement at the beginning of your program, Auto Time And Date will not destroy the first line. If it doesn't find a REM here, it does nothing.

Type in Auto Time And Date and be sure to save a copy *before* running it the first time because it erases itself from memory. It first asks you to enter today's date. If, for example, today's date is December 21, 1985, enter:

```
12/21/85
```

and press RETURN. You must enter eight characters, or you'll get an error message.

Next, enter the present time. If the time is, say, 9:35, enter:

```
0935
```

Four digits are required (no colon). Then AM or PM is requested. Enter A or P.

The time and date are displayed and you're asked if they're correct. If they are, press RETURN. If not, type N and press RETURN. You'll be prompted for the time and date again.

Now load or type in a program and enter something like this as your first line:

```
10 REM 18 CHARACTERS OR MORE
```

Now when you list your program, the first line will contain the date and time:

```
10 REM 12/21/85 09:35 PM
```

The time is updated each time you save or list your program—provided Auto Time And Date is still activated. The date is not changed when the time passes midnight.

How The Program Works

Auto Time And Date is a machine language program in the form of a BASIC loader. The machine language is located at 49155 but is relocatable, so you can put it elsewhere. Change the value of variable SA in line 100 to the new starting address.

The program works by changing the vectors for the LIST and SAVE routines to point to the machine language routine. Each time you enter the command LIST or SAVE, BASIC will jump to the machine language routine first. The routine updates the time on the first BASIC line and then jumps to the regular SAVE or LIST routine.

It uses the Time Of Day (TOD) clock, which is located in the CIA #1 chip. For more information on this clock see the *Commodore 64 Programmer's Reference Guide.*

See program listing on page 143.

A Printer For All Reasons

Search For The Best High Quality Graphic Printer

If you have been looking very long, you have probably discovered that there are just too many claims and counter claims in the printer market today. There are printers that have some of the features you want but do not have others. Some features you probably don't care about, others are vitally important to you. We understand. In fact, not long ago, we were in the same position. Deluged by claims and counter claims. Overburdened by rows and rows of specifications, we decided to separate all the facts — prove or disprove all the claims to our own satisfaction. So we bought printers. We bought samples of all the major brands and tested them.

Our Objective Was Simple

We wanted to find that printer which had all the features you could want and yet be sold directly to you at the lowest price. We didn't want a "close-out special" of an obsolete product that some manufacturer was dumping, so we limited our search to only those new printers that had the latest proven technology. We wanted to give our customers the **best** printer on the market today at a bargain price.

The Results Are In

The search is over. We have reduced the field to a single printer that meets all our goals (and more). The printer is the SP-1000 from Seikosha, a division of Seiko (one of the foremost manufacturers in the world). We ran this printer through our battery of tests and it came out shining. This printer *can* do it all. Standard draft printing at a respectable 100 characters per second, and with a very readable 12 (horizontal) by 9 (vertical) character matrix. This is a full bi-directional, logic seeking, true descender printer.

"NLQ" Mode

One of our highest concerns was about print quality and readability. The SP-1000 has a print mode termed Near Letter Quality printing (NLQ mode). This is where the SP-1000 outshines all the competition. Hands down! The character matrix in NLQ mode is a very dense 24 (horizontal) by 18 (vertical). This equates to 41,472 addressable dots per square inch. Now we're talking ***quality*** printing. It looks like it was done on a typewriter. You can even print graphics using the standard graphics symbols built into your computer. The results are the best we've ever seen. The only other printers currently available having resolution this high go for $500 and more *without* the interface or cable needed to hook up to your computer.

Features That Won't Quit

With the SP-1000 your computer can now print 40, 48, 68, 80, 96, or 136 characters per line. You can print in ANY of 35 character styles including 13 double width and 3 reversed (white on black) styles. You not only have the standard Pica, Elite, Condensed and Italics, but also true Superscripts and Subscripts. Never again will you have to worry about how to print H_2O or X^2. This fantastic machine will do it automatically, through easy commands right from your keyboard. Do you sometimes want to emphasize a word? It's easy, just use **bold** (double strike) or use *italics* to make the words stand out. Or, if you wish to be even more emphatic, underline the words. You can combine many of these modes and styles to make the variation almost endless. Do you want to express something that you can't do with words? Use graphics with your text — even on the same line. You have variable line spacing of 1 line per inch to infinity (no space at all) and 143 other software selectable settings in between. You can control line spacing on a dot-by-dot basis. If you've ever had a letter or other document that was just a few lines too long to fit a page, you can see how handy this feature is. Simply reduce the line spacing slightly and ... VOILA! The letter now fits on one page.

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Soft Write Protector For Disks

Don Lewis

It's too easy to accidentally scratch an important program, especially if you often use the wild card symbols. Here are two utilities that allow you to lock and unlock individual files—or entire disks. For the 128, 64, VIC, Plus/4, and 16.

Write protecting a disk typically involves covering up the write protect notch. This works fine until someone removes the tag. If you really want to protect a program (or disk) from being scratched, "File Protector" and "Disk Protector" are the solution.

Once a file or disk has been protected, the scratch command will be disabled. You can load protected programs, read protected files, rename them, copy them, and so on. You just can't scratch the files. (Note that this is not the same as *copy protection*, a collection of techniques for preventing software piracy.) The programs simply protect files against accidental scratches. Anyone who keeps archive or backup files, including schools and user groups, should find it useful.

File Protector

Program 1 locks individual disk files. There are no special typing instructions; just type it in and save a copy. When you run it, follow the prompts on the screen. It lists programs and files on your disk, up to eight at a time. Each program should be numbered. When you see the file you want to lock, press the corresponding key.

If you discover you need to unlock a file so it can be scratched, load File Protector and list line 100. Change **P$="LOCK"** to **P$="UNLOCK"** and run it. Select the files to be unlocked by pressing the number next to the filename.

Locked files will always have a less-than sign (<) to the right of the file type. Should you choose to lock a program called TAPIR and a sequential file called SOMEDATA, they would look like this when you list the directory:

```
11   "TAPIR"        PRG<
17   "SOMEDATA"     SEQ<
```

Curiously, the ability to lock a file was included in the disk operating system (DOS), but Commodore didn't provide a direct command for locking a file. You have to read the directory sector by sector into a buffer and then use memory manipulation commands to change the appropriate bytes.

Disk Protector

The Disk Protector and Disk Unprotector programs are much shorter—about ten lines each. You don't have to choose which program will be unscratchable; Disk Protector affects the entire disk.

To lock a disk, load Program 2. Insert the disk you want to lock and run the program. It's that simple. To reverse the process, load Program 3, insert the locked disk, and run. Normally, the first line of a directory contains a 0, the disk name, the ID, and a "2A". On protected disks, the 2A will be changed to a 2P ("P" for "Protected").

Here's how it works: Commodore has used several versions of DOS over the years. The 1541, like the 4040 (a disk drive for the Commodore PET), contains DOS version A. The identifying letter A (CHR$(65)) is found on track 18, sector 0, byte 2. When a disk is first accessed or when it is initialized, the letter A is copied into location $0101 of the 1541's memory. It also gets copied, along with the entire block allocation map (BAM) into page 7. Since it's at byte 2 on the disk sector, it ends up at location $0702 in drive memory.

If the DOS detects a character that's not an "A," it thinks the disk was formatted on another version of DOS, so it allows files to be read, but not written to. Attempts to write a file or save a program to a protected disk cause an error #73: DOS Mismatch.

Unprotecting the disk requires a little trick. Since the disk has been write-protected, the DOS version identifier at track 18, sector 0 cannot be directly changed back to an "A". We have to tell the disk drive that it's working with a 1541-compatible disk. Before writing back to track 18, we have to send a memory-write (M-W) command to modify the memory locations that contain the DOS version (remember, the A on the disk has been copied into the disk drive's memory at $0101 and $0702). With that done, the disk drive believes that it's got the right kind of disk and we can write the letter A back to track 18, unlocking the disk.

I'd like to acknowledge the book *Inside Commodore DOS* by Richard Immers and Gerald Neufeld (1984, Datamost). The 1541 memory maps published in this book were very useful.

A Word Of Caution

Improperly typed disk commands can wreak havoc on information stored on a disk. Carefully type each line, and double check punctuation marks like commas, semicolons, colons, and quotation marks. When you've finished typing, test the programs by locking and unlocking a junk disk, just in case something was typed wrong.

See program listings on page 145.

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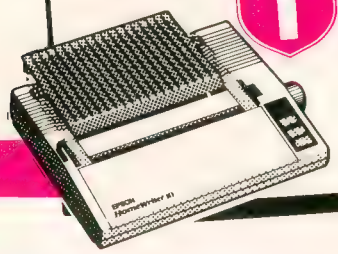

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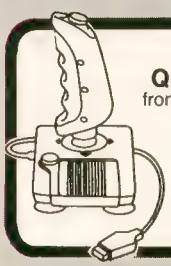

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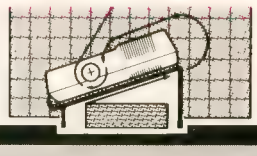

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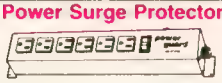

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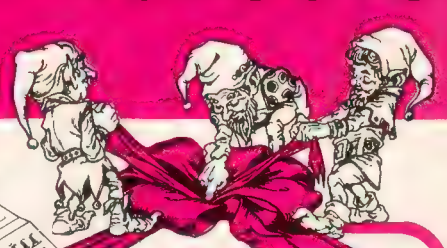

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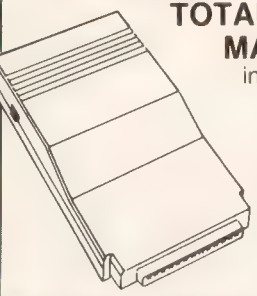

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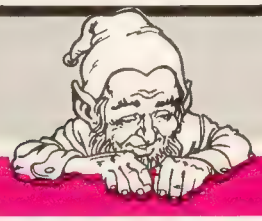

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Trackmouse

Warren Block

This useful programming routine lets you move the cursor anywhere on the screen using a joystick or trackball. For the Commodore 64.

With the advent of Apple's Macintosh, the mouse has become a popular input device. It provides a fast and easy way for moving the cursor anywhere on the screen. By contrast, the cursor control keys on the 64 have a rather clumsy arrangement. A more logical arrangement would be four separate keys in a diamond pattern like those found on the Plus/4 or 16. Another feature of 64 cursor control which can be improved is cursor movement. You can't move diagonally. You must first move up or down to a line, and then across to a character. One solution to both of these drawbacks is freedom of movement without cursor keys.

"Trackmouse" provides that solution, and with only 13 program lines. It gives 64 owners mouse-like control of the cursor with a joystick or trackball.

After typing in Trackmouse, save it on tape or disk, and run it. With a joystick or trackball plugged into port 2, you can now freely move the cursor around the screen. Pressing the fire button is the same as tapping the RETURN key. Pressing RUN/STOP–RESTORE turns off Trackmouse, but it can be turned on again by typing **SYS49152.**

Trackmouse is designed to be used during programming and debugging, but cannot be used while a program is running unless the program reads the cursor keys with a GET statement. For example, the following lines can be used with Trackmouse to control the movement of a spaceship:

```
10 GET A$:IF A$="{UP}" THEN move ship up
20 IF A$="{DOWN}" THEN move ship down
30 IF A$="{LEFT}" THEN move ship left
40 IF A$="{RIGHT}" THEN move ship right
```

To read the fire button, check if the RETURN key is pressed:

```
50 IF A$=CHR$(13) THEN fire missile
```

How It Works

The program POKEs in a machine language routine starting at location 49152. The routine is relocatable, however, so you can put it elsewhere in memory. Just change line 110 to set the variable S equal to the new starting address. If you do this, be sure to SYS to the new address instead of 49152 to turn Trackmouse back on after pressing RUN/STOP–RESTORE.

Trackmouse is tacked onto the ordinary keyboard interrupt routine at $EA31 so that when an interrupt is generated (every 1/60 of a second), the computer executes Trackmouse first. The program reads the joystick or trackball and interprets its movements into pseudo-keypresses which are then put into the keyboard buffer. The computer thinks that you actually pressed the cursor keys.

Since this program changes the interrupt vector at $314–315, it will not work with other programs that also use this vector.

Trackmouse

```
10 S=49152:REM STARTING ADDRES
   S                          :rem 134
20 FORA=STOS+84:READB:POKEA,B:
   C=C+B:NEXT                 :rem 58
30 IFC<>8486THENPRINT"{CLR}TYP
   ING ERROR!":STOP           :rem 34
40 POKES+7,S/256:POKES+2,S-256
   *PEEK(S+7)+13              :rem 217
50 SYSS                       :rem 183
60 DATA 120,169,13,141,20,3,16
   9,192,141,21,3             :rem 98
70 DATA 88,96,230,2,165,2,41,3
   ,208,61,173                :rem 225
80 DATA 0,220,73,255,168,41,1,
   240,2,208,28                :rem 5
90 DATA 152,41,2,240,2,208,24,
   152,41,4,240               :rem 249
100 DATA 2,208,20,152,41,8,240
   ,2,208,16,152              :rem 39
110 DATA 41,16,240,23,208,12,1
   69,145,44,169,17           :rem 210
120 DATA 44,169,157,44,169,29,
   44,169,13,160,1            :rem 177
130 DATA 132,198,141,119,2,76,
   49,234                     :rem 240
```

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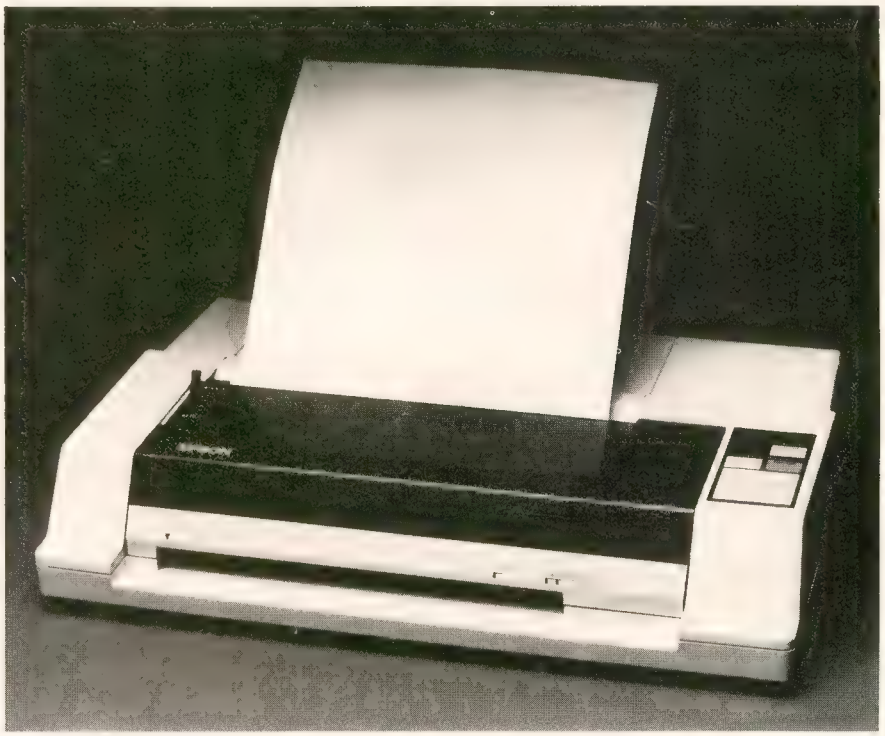
The Epson HI-80 Plotter

When many Commodore owners think of a plotter, they probably visualize the small 1520 plotter that Commodore manufactured as an inexpensive (under $100) peripheral for the VIC-20 and Commodore 64. Some may be familiar with the large, blueprint-sized plotters—over $2,000—produced by Hewlett Packard or Houston Instruments, and used in industry or for scientific applications. The Epson HI-80 four-color plotter fits neither of these categories. It uses regular 8-1/2 by 11 inch or legal-sized paper, bond or transparent acrylic, and has a price tag that small business and home users can afford. Although the HI-80 has a manufacturer's list price of $599, it can often be found in stores for less than $500—no more expensive than a high quality dot-matrix printer.

The HI-80 is easily interfaced to the Commodore 64 or 128. We used a Cardco CARD? B, but a CARD? +G or comparable interface from another manufacturer should work as well. With a 64, the HI-80 can be used either from BASIC or with a word processor—we used *Easy Script*—and is addressed by using the same ASCII character string codes as an Epson MX, RX, or FX-80 printer. It has excellent quality print when used as a printer, but is, of course, very slow when compared to a state-of-the-art dot-matrix printer. We recommend using it only as a printer when it is necessary to combine text and graphics. One friend easily wrote a short program for making signs, and by first printing a grid with X and Y coordinates, was able to place pie charts and bar graphs exactly where he wanted them using HI-80 commands. Users with 64s and some programming ability should be able to make some very impressive presentations with the HI-80 plotter.

It is with the Commodore 128 in CP/M mode that the HI-80 really shines. The CP/M version of Epson's *KeyChart* software (about $30) loads right into the 128 in CP/M mode, providing 128 users with a tool to create sophisticated, full-color presentation graphics in minutes. If this isn't enough, the program provides an interface to most popular CP/M spreadsheets, and allows loading text files from most CP/M word processing programs. This means that you can create graphs from spreadsheet calculations, and mix them with text from a word processor. *Keychart* supports more chart types than there is room to list here, including multiple slice exploded pie charts and scatter plots—all types can be mixed on one sheet and combined with text.



I highly recommend the HI-80, particularly to 128 owners. With the *Keychart* software, it allows a $300 computer to perform functions that up to now were accessible only from MS-DOS or CP/M machines costing many hundreds of dollars more.

Specifications:

Speed: Plotter Mode 230mm per sec. (9.96 inches per second)

Printer Mode 165mm per sec. (6.5 characters per second)

Motion Command Rates: 15 moves per second maximum.

Maximum Plotting Area: 267mm × 192mm (10.51 inches by 7.56 inches)

Resolution (step size): 0.1mm (.0004 inches)

Positioning accuracy: 0.3mm plus 1 percent of distance moved.

Pen Types: ballpoint (water-based ink) and fiber tip (water-based and oil-based inks); proprietary pens in holder clip.

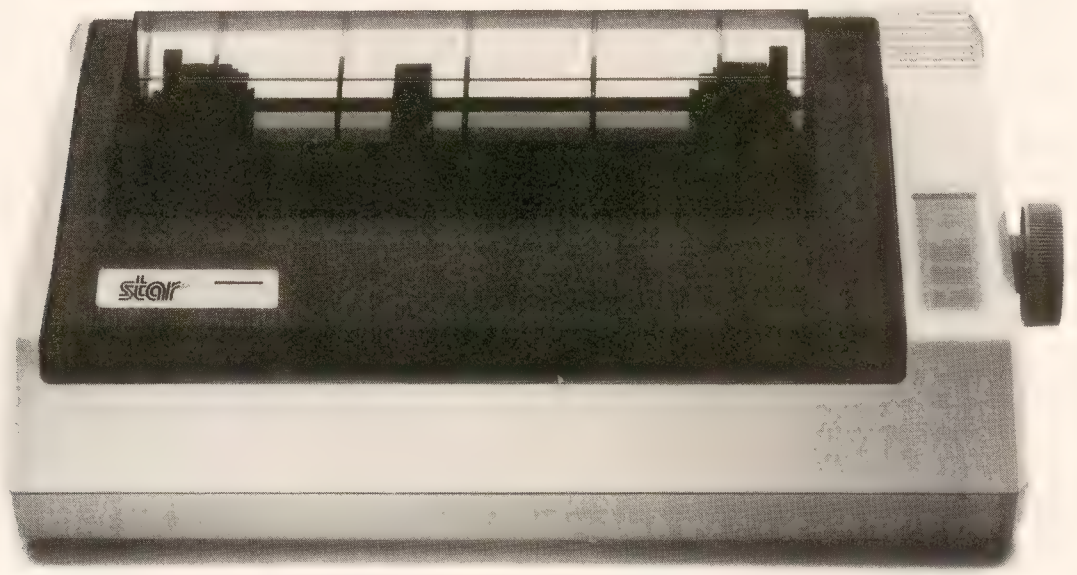
Pen Colors: plotter uses four at once; software will prompt user to change pens if desired. Ten colors available. Black, red, blue, and green fiber tip supplied with plotter.

Options: Hewlett Packard-Emulation Board, allowing use of large library of software designed for H-P 7470A plotter, mostly in MS-DOS and CP/M. Epson *Keychart* software in CP/M or MS-DOS, allows user to create plots and charts either from raw data or with files from *SuperCalc*, *Lotus Symphony* and *1-2-3*, *Multiplan*, *Wordstar*, and many others.

Interface: Centronics Parallel standard.

Plotter Controls: Mode 0—Epson proprietary mode, (ASCII text driven),

A BRIGHT NEW STAR FOR A COMMODORE TO PRINT BY



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- Color of Cursor
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Also included is the 2 Key Load. Pressing the Shift/Run Stop will load "*", 8, 1.

You can choose from any of these colors: Black, White, Red, Light Red, Cyan, Purple, Green, Light Green, Blue, Light Blue, Yellow, Orange, Brown, Dark Grey, Medium Grey, Light Grey.

P.S. . . . It sure is nice having your own colors and message on the screen on power up!

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Here, at last, is a program that will protect your software programs from unauthorized duplicating. 1 to 1 million copies can be protected, fast and easy.

- Specially designed for the C-64 and 1541 Disk Drive.
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- Fully compatible with almost all machine language and basic programs — can even support chained programs.
- Contains a special feature which protects your program from being 'broken.'
- Incorporates all the latest techniques in program encryption and protection.
- Each system has been specially prepared and is unique from all other systems — only **you** are able to make working duplicates of your own protected programs.
- Simple and easy to use — entirely menu drive with prompts
- Will stop virtually all software copiers from duplicating your programs.
- Fast and reliable protection routine does not take away any useable space from your disk — all 664 blocks are available for use.
- Easy to follow step by step instructions are included on the disk
- A **must** for all programmers who do not want their programs to be in public domain!

Even the "nibblers" can't copy them. Not even *Disk Maker, *Mister Nibbles, *Copy II, *Ultra Byte or *Fast Hackem. The time to protect you disk is only 5 (five) seconds and each Master Lock makes a different protection scheme. Only.

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*Disk Maker™, Basix
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*Copy II™, Central Point Software
*Ultra Byte™, Ultra Byte
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TOOL BOX

This disk has over 100 routines, some of them are routines for protection, smooth scrolling, modem routines, and sound and color routines: bootmaker, paddle and joystick: read terminal, auto dial, auto answer. They can easily be incorporated into all of your programs. It is also fully documented. With this disk alone you could build your own program. This disk has a lot of tricks that are used in commercial software

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is absolutely the easiest terminal program available anywhere.

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Message . . . is a unique graphics integration package which allows you to continuously display hiresolution and multicolor files. Up to 12 files* may be stored in memory and displayed from 1 to 59 seconds each.

Message . . . can use Print Shop 'Screen Magic' files, Flexidraw files, Doodle!, Koala Painter, and more! **Message . . .** even comes with a 'Screen Maker' program to create your own message files!

Use **Message . . .** for advertising displays, titles for home videos, art shows, etc. . . . **Message . . .** even plays background music to accompany displays and you can create your own music files with the 'Music Maker' program.

Also included are 'Graphic Aids' utilities for conversion of different file types, including conversion of Koala Painter files to Doodle! or Print Shop!

The price for all this? Just $19.95 including shipping and handling

*Actual number of files dependent on file complexity.

MAGNUM LOAD

Programed by Jim Drew

MAGNUM LOAD is a new replacement KERNAL (operating system) ROM chip for your Commodor 65 or 128 computer that will load and verify programs up to 6 times faster than before. The tape routines have been removed from the old chip and in their place have been put a high-speed loader, high-speed verify, and disk driver no-head-rattle routine. Unlike the older cartridge fast loaders, no ports are tied up at the rear of the computer, the screen is not blanked during loading and there is no wear-and-tear on the expansion port. For maximum convenience and performance, the chip is installed directly in the circuit board Generally a socket has already been provided to make the operation easy, but occasionally some soldering may be required. Now you can give your 1541 disk drive "1571 speed."

Rather than give you more exagerated claims about how many times faster our ROM chip is compared to the slower cartridge versions, a comparison chart is supplied listing MEASURED loading times.

Program	Star-Dos	Reg. Load	Mach 5	Fast Load	MAGNUM LOAD
Pitstop II	?	144 sec.	43 sec.	41 sec.	**31 sec.**
Music Shop	?	105 sec.	105 sec.*	105*	**21 sec.**
Hitchhiker's Guide to the Galaxy	?	70 sec.	70 sec.*	N.G.**	**68 sec.**
On-field Football	?	149 sec.	66 sec.	63 sec.	**56 sec.**
EASY FINANCE I	?	58 sec.	13 sec.	13 sec.	**11 sec.**

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*Will not fast load - defaulted back to regular load

**Failed to load at all

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- Translates any machine language program into easy-to-ready English descriptions with complete explanations of each command.
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- Gives you three ways of accessing programs:
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  2. **Will read and list programs from MEMORY**
  3. **Direct user input (from magazines, etc.)**
- Can be used to locate and examine any machine language program's protection routines!
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- Printer option for complete hard copy listings!

You no longer need to be an EGGHEAD to read Machine Language.

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THE PERFECT COMPANION PROGRAM TO D-CODER!

Allows you to easily make changes in machine language programs . . . right on the disk!

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- Notation of ASCII text equivalents for easy spotting of embedded text strings!
- Handy reference display of all assembly language commands and their ML numerical equivalents!
- Byte splitter for easy splitting of decimal addresses into low byte-high byte format!

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SOFTWARE PROTECTION HANDBOOK Third Edition! Now Available!

If you're **tired** of being harassed by **protected software** and too many **copy** programs, then this is the book for you! This 224 page manual covers the gamut from legalities to protection methods to step-by-step back up procedures. Now you can learn both how to **protect and unprotect** software! The techniques covered include copying cartridges to tape or disk, tape protection, and disk protection. Disk protection covers error numbers 20, 21, 22, 23, 27 and 29 **plus** single track formatting, header modification, header swapping, half track reading and writing, reading and modified bit densities, formatting illegal track/sectors, sync writing and **more!** The Third edition **explains**, tells how to **detect** and how to **write** them with included software.

C-64 Book Only ..... **$19.95** US

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'TRACK TRAP' The 1541 Disk Expander!

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Track Trap disk expanded manual ..... **$9.95** US

Top Secret Stuff I and Top Secret Stuff II

Programed by Jim Drew

Are both collections of 20 programs per diskette (that works out to about $1.00 per program!) that help you explore and enhance your Commodore 64 and/or 128 and 1541 disk drive. Now you can unlock many secrets formerly known only to top machine language programmers by using these sophisticated "tools." If you have ever been curious about the inner workings of your computer system, now is your chance to dig in and find answers with the help of these programs. These collections of programs have gotten rave reviews from actual users, and we are sure that you, too, will be pleased.

The programs include on each diskette are listed below

TOP SECRET STUFF I

The Dock (view/repair disk contents)
Sync Checker (diskette)
Imbedded Track Number Creator
Disk Manipulation System
3 Minute Copy (backup program)
Diskette Matcher (compare sectors)
Unscratch A File (recover file)
View BAM (block allocation map)
1541 Read/Write Test
½ Track Reader
Header Reader (display disk header)
Sync Maker
Device Number Change (disk drive)
Electronic Arts Backup
Drive Mon (disk drive m/l monitor)
Diskette File Log (start-end address)
Write-Protect Sensor Test
Repair A Track (recover data)
Fast Format (10 seconds)
½ Track Formatter

$19.95

TOP SECRET STUFF II

RAM Test (test Computer RAM)
Copy $AOOO-$FFFF (under ROMS)
Display G.C.R. (All sector data)
Un-Write Protect (diskette)
Unnew Program
Wedge - $8000
Smooth Scroll (messages up screen)
Koala Dump (koala pad screen dump)
Disk Manipulation System
Disk Eraser (20 second clean wipe)
Split Screen (TWO screen colors)
Disk Protection System (stops copies)
Write Protect (diskette)
Boot Maker (autobook BASIC programs)
Wedge - $COOO
Diskmatcher II (high speed version)
No Drive Rattle (on reading errors)
3 Times Disk Drive Head Speed
Monitor Test (check video monitor)

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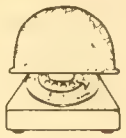
WAR GAMES AUTODIALER



1. **Auto Dial** will automatically dial a set of numbers you choose
2. **Review Numbers** will review numbers that were answered by a computer
3. **Save Numbers** will save numbers where a computer answered
4. **Hardcopy of Numbers** will print out list of numbers where a computer answered.
5. **LOAD Numbers** will load in numbers to continue where it left off
6. **Continue** will pick up dialing where it was interrupted

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- 300/1200 Band
- Remote access for sysop
- 2 levels of security for up and down load
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- Secret highest level
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– Mark Brown, INFO 64

"...overall ***COMAL*** averages out to about three times faster than BASIC."
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as rated by The Book of Commodores 64 Software 1985.

Overall Rating	A	A	*Reliability*
Ease of Use	A	A	*Error Handling*
Documentation	A	A	*Value for Money*

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*Shipments may include 2 disks of programs on 1 double sided diskette.
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with single commands for marked vertex, polylines, circles, points joined with cubic spline curves ("French curve" line drawing), crosshatched boxes and pie chart segments, and text with continuously variable size and orientation.

Mode 1: emulates Western Graphtec MP-1000 (Wantanabe Instruments MyPlot II)

Mode 2: printer mode emulates Epson RX-80 printer, including 10 international character subsets (and four bit image modes). All modes include standard 96 ASCII printing character set plus graphics and international character subsets.

—Betsy Byrne

Epson America, Inc.
Computer Products Division
2780 Lomita Blvd.
Torrance, CA 90505
$599

Calc Now!

Cardco's approach to software might be summed up like this: Make it easy to use for the beginner, add advanced features to give it substantial power, then sell it at a reasonable price. *Calc Now!* is a fine spreadsheet, a product of this philosophy. Like most of Cardco's offerings it is "user friendly" and bug-free. It has substantial power for home and many small business applications, and it represents solid value. Its strongest point is its intuitive quality: How you think it *might* work, it *does*.

User accessibility is aided by help screens for the special function keys and by a simple keyboard overlay, similar to those found in other Cardco products. Speed of data handling/access is increased by the incorporation of a fast-load routine. (Access *Calc Now!* with **LOAD"*",8:RUN**. With this method, which uses a fast-load procedure, the program is up in less than 30 seconds, whereas the method outlined in the manual takes a minute and ten seconds.)

Grid range is more than adequate (64 × 254), and data memory is a hefty 39K. A broad selection of built-in math (15) and range (9) functions are available to the advanced user, as are a variety of data and grid formats (all of which—along with cursor position—are saved with the grid). There is a

handy cell-protection feature for business-oriented applications, and a calculator mode which allows change of cell value via formulas (example: "multiply this cell by 4 and add the value in A3").

A graph option for numeric values (represented by asterisks) is among the data formats; and basic disk functions—directory, initialize, delete, rename—are accessible from within *Calc Now!*. Relocatable loading is a useful feature, particularly for reclaiming partially corrupt data that cannot be accessed through a normal load. Titling options are flexible; and columns can be easily inserted or deleted and their widths varied individually or as a group. Dual windowing, with either horizontal or vertical split, may be cursor-synchronized or independent.

Three capabilities are particularly noteworthy: First is the alpha or numeric sorting of rows on a given column, either *all* rows or a selected *range* (no sorting occurs if one of the extremes extends beyond the range of data). This feature makes *Calc Now!* useful for simple database applications.

Second is the valuable IF-THEN-ELSE conditional logic, which gives the program a degree of "intelligence." Last is the repeat/copy option, a sure timesaver when the same data must be placed in many cells. The information to be copied may be a *range* of rows or columns, as may its destination. (Note, however, that this refers to a range of rows *or* columns, not a *block* of rows/columns. A distinction is not clearly made in the documentation, though it might be deduced from the tutorial.)

Calc Now! outputs files to disk or printer in a variety of formats, including two for use with Cardco's *Write Now!* word processor (one is designed for *Write Now!*'s mail merge feature). The disk versions are program (text) files which may not work with other word processors (Cardco does not claim they do).

Documentation is mainstream Cardco—thorough, and a bit folksy. Everything is there, in reference form, though it is often somewhat difficult to find. A most notable addition, however, is the *extensive* tutorial section—66 pages—which takes the first-time user step by step in several lessons through a typical small-business application. Two rudimentary templates—Checkbook and Budget—are included on disk, but have nothing to do with the tutorial and are not mentioned elsewhere in the manual.

Cardco continues to be interested in its customers, providing a technical support telephone number (not toll-free). In summary, *Calc Now!* is an excellent spreadsheet from a solid, customer-oriented software company.

—Art Hunkins

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$39.95 (disk)

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A data base program to create and maintain files of tax related items (medical, car expenses, etc.) that can be used directly by the tax programs.

- Can be used all year round. Also good for many other accounting jobs (checkbook balancing, etc.)

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Charles Goren: Learning Bridge Made Easy

Contract Bridge was first played around 1925. It has a distinguished pedigree: a refinement of Auction Bridge, which in turn grew out of Bridge/Whist. A few rule changes made a more interesting game and assured the success of "Contract." Today, there are more than 200,000 members in the American Contract Bridge League.

Some people take this card game very seriously, as I did when I first began playing in graduate school. At that time, I read several books and played almost daily with excellent players. Now I am lucky if I average one session a month, and the caliber of my play has deteriorated. Furthermore, I haven't kept up with the latest theories and conventions. In short, I've become an average player.

The average bridge player is not very skillful, and errors due to poor knowledge of the fundamentals detract from the enjoyment of the game. What can help is the software reviewed here, subtitled: "A complete, self-paced program for learning the fundamentals of Standard American Contract Bridge bidding and play."

This program for the Commodore 64 is both a quiz and tutorial on contract bridge. You're given the choice of ten quizzes on bidding or selecting any one of 100 hands to play. The quizzes are coordinated with a slim manual. Each quiz has a "help" option and a vast number of randomly selected exercises. When you make an error, the correct answer and logic are shown.

The following quizzes are included:

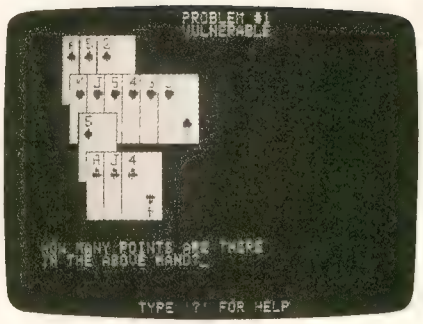
1. Hand evaluation
2. No trump opening bids
3. Opening 1 of a suit
4. Opening strong hands
5. Preemptive opening bids
6. Responding to 1 of a suit
7. Responding to a 1 no trump opening bid
8. Rebids by opener
9. Rebids by responder
10. Direct competitive auctions

A cursory glance at the topics show that they cover much of the fundamentals of bidding. Anyone mastering these will surely bid better than the average player. And reaching the correct contract is a major objective of the game.

I found the quizzes generally very helpful. The player's manual is good but very brief. It, and the program, will be of most help to people with some knowledge of the game. Even so, it may be a good idea to have close at hand one of Goren's more comprehensive books in order to bone up on esoteric rules and exceptions. I found it irritating to be confronted with an unamplified statement that I had not seen on either the "help" screen or in the manual, with no further reference on the subject. With a larger text at hand, the rationale behind a rule like, "No preempts with a 4 card major suit," could probably be clarified.

The eleventh quiz choice allows you to play 100 practice hands which are annotated in the player's manual. This is by far the best feature of the software. The hands are straightforward at first, employing standard unopposed bidding to game. Towards the end, more advanced plays, like defensive signals and endplays, are covered. In my experience, the only signal most people recognize is a kick under the table. The average player will profit from the experience of bidding and playing under conditions where errors and omissions are analyzed.

Two good points about the play section are worth singling out. I particularly admire the screen representation of the bridge table and the clever way the discards (book and overtricks) are shown. Also, if the remainder of a played hand is a lay-down, the program properly asks if you want to play it out. There is nothing more boring than being forced to play out every card when you could claim a rest.



One negative point here deserves mention. If two lines of play are equally good, the program may allow only one. For example, at the end of one hand, only a few cards were left, and it didn't matter which one I discarded. However, the program insisted on its way for no apparent reason. This might be a source of confusion to beginners.

My ability to play bridge was frozen in time when I learned it years ago: Retraining was called for. Working with this program, I picked up a few tricks (pun intended). I can recommend it to beginners who want an easy way to learn and practice the fundamentals of bidding and play, and for intermediate players who need review.

—Harvey B. Herman

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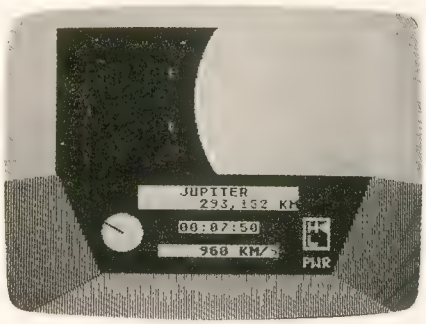

This is *The Halley Project: A Mission In Our Solar System*, a package for the Commodore 64 from Mindscape which manages to be both entertaining and educational. Tom Snyder, the author of *Snooper Troops*, and other best-selling educational games for children, has collaborated with Omar Khudari on this challenging puzzle. You won't be

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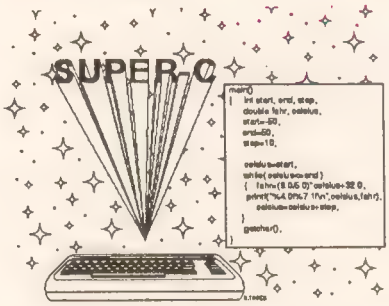

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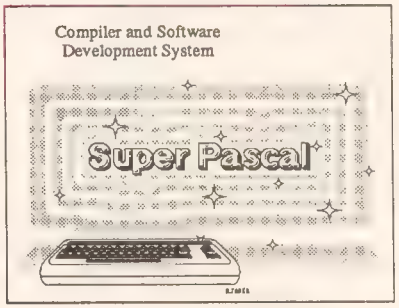

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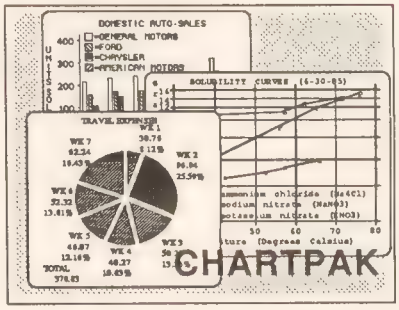

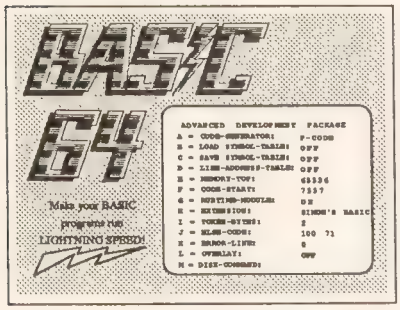

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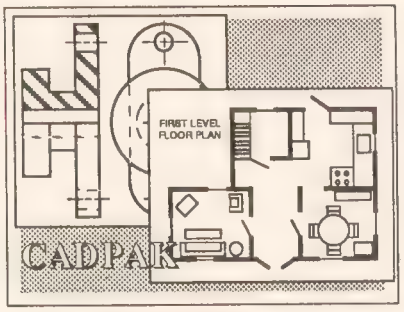

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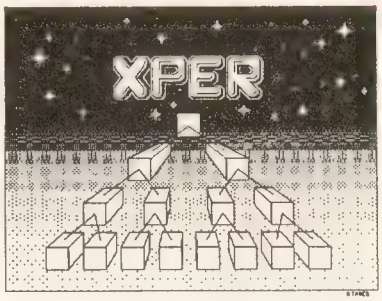

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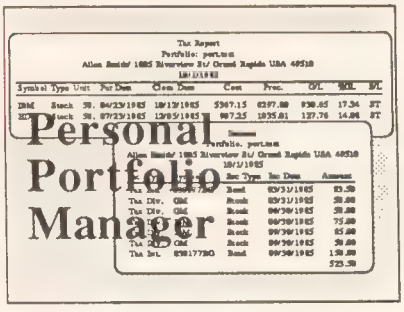

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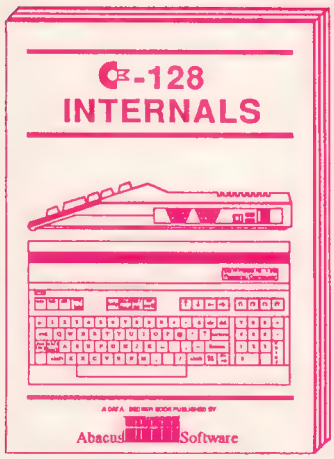

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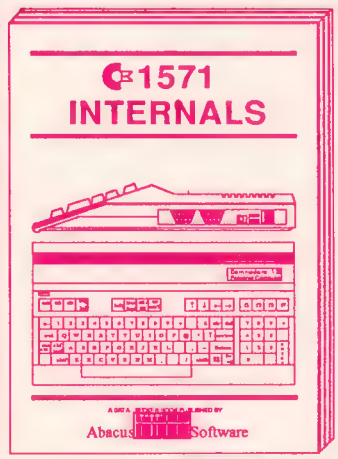

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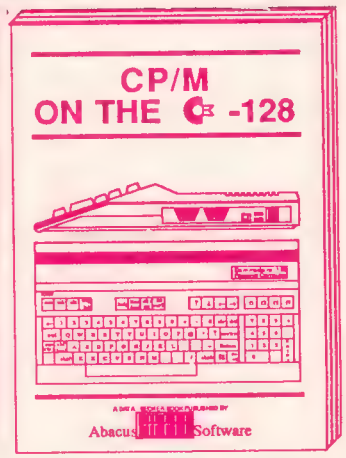

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fighting aliens in this space game, but you will be tested to the limits of your knowledge. Navigating through the solar system, using radar to locate the planets, then picking up your strip chart of the constellations to identify the appropriate star system is a challenge for the best celestial navigator.

By the time you complete your tenth mission, you'll recognize at a glance the signs of the Zodiac from the accurate screen displays. And you'll have acquired new knowledge about the planets of our solar system.

You don't win or lose in this game, only complete each of the assigned series of tasks. After finishing your missions, you'll be awarded the rank of Starbird. A secret number will appear on the screen which you can send to Mindscape to register your success. You'll then qualify for "The Final Project," a mission so secret that details will be mailed to you only after you've proven your ability as one of the best pilots in the solar system.

Although scientifically accurate, the graphics used in *The Halley Project* could be a little better in some cases. It would be nice to see the rings of Saturn during your approach, or the red spot and bands on Jupiter. But you won't soon forget the sight of the Earth eclipsing the Sun, followed by an eclipse of the Moon, if you're able to position your approach just right.

The Halley Project should be entertaining and educational for just about anyone over the age of 12 who has a passing interest in the heavens. However, you may need to consult an encyclopedia or a text on astronomy to complete the missions. The clue for your next objective might be to land on a moon which is larger than a planet. You can take a chance on one of the Jovian Satellites, or take a few minutes to look up some information.

Now let's see, is Titania a moon of Saturn or Jupiter?

—George Miller

Mindscape, Inc.
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Omniwriter/Omnispell

Of all the word processors for the Commodore 64 I've had the opportunity to use so far, I prefer *Omniwriter/Omnispell* by HES.

The first thing about *Omniwriter* that impressed me was the documentation. The manual is well written and easy to follow. After spending only five to ten minutes with it, I felt I was ready to begin experimenting with the software. Thanks to the handy reference card and function key overlay, I was able to quickly and easily learn how to find my way around within *Omniwriter*. I was pleasantly surprised to find a help file and sample letter that come ready-to-load from disk. (They load as normal word processor documents.)

My favorite feature is the side scrolling capability. Since the 64's screen can only contain 40 characters per line, as you type or move the cursor toward one side of the screen, the text scrolls horizontally, moving the hidden areas of your workspace onto the screen. Similarly, you can scroll the screen vertically. The screen can be thought of as a window you can move anywhere over your document to view any portion of it. It even side scrolls up to 241 columns. This feature allows you to see almost exactly how your finished document will appear on paper and is one of the features of *Omniwriter* that puts it in a class by itself.

Another excellent feature of *Omniwriter* is its ability to automatically reformat your text on the screen as you change the page width. You can type in a document in 40 columns if you prefer, and then automatically reformat it to 80 columns for printing.

Entering text is very easy. As you type, the screen scrolls horizontally over the document when necessary, and it formats your document for you automatically. When you exceed the predetermined right margin, it brings the current word down to the next line as you continue typing. Typing a carriage return signifies the end of a paragraph. When you print your document, you have the option of having the right margin automatically justified.

The function keys allow you to quickly move forward and backward by a page or a screen at a time, move to the opposite end of a line, move to the next tab or end of line, delete text and/or insert text.

Deleting and inserting text is easy. Large portions of text can be quickly deleted by highlighting. Using the cursor controls, you highlight the text you wish to delete. Pressing RETURN then causes the highlighted text to vanish. Your document is automatically reformatted as you delete or insert text. Another function allows you to easily copy or move text from one part of the document to another by highlighting.

Special keystrokes in *Omniwriter* allow you to do such things as center a line of text, indent a paragraph, or indicate a page ending. In addition, you may set any number of tab stops and even align columns of numbers by decimal points with "numerical tab stops." There are built-in printer format symbols and the provision for up to ten user-definable printer format codes. These may control such print features as underlining, subscripts, boldface, etc. If your printer is not one of those supported by the predefined format codes, you can define your own.

In addition to the normal workspace for the main document, there are three additional "pages." One of them is a work page for your own personal notes. This can also be used to hold information to be merged into the main document. Information can be merged from an *Omniwriter* document or a BASIC sequential file as well. The two other pages are for headers and footers. These can hold information to be printed at the top or bottom of every page of your document and may also be used for page numbering.

Omnispell, the spelling checker provided with *Omniwriter*, is well done and nicely integrated. The dictionary of 30,000 words seems to be more than adequate for most purposes. In ordinary documents, such as this one, there are very few words—besides names and special technical terms—it will not recognize. My only major complaints about *Omniwriter* are the lack of a fully automatic pagination and page numbering option, and the absence of a provision to print more than one copy of a document at a time. You must indicate end of page with a special control character for each page, and another control character is used to indicate the placement of the page number on each page. In addition, the print command must be issued each time to print another copy. This requires you to start the next copy printing when the previous one is done. Other than these minor gripes, it seems the author has provided for just about everything one might want or need to do.

Omniwriter is a complete word processing package with mail merge capability and an integrated spelling checker. Its numerous advanced and easy-to-use features, along with its reasonable price, make it a flexible product which should meet the needs and budget of almost everyone.

—Michael Kleinert

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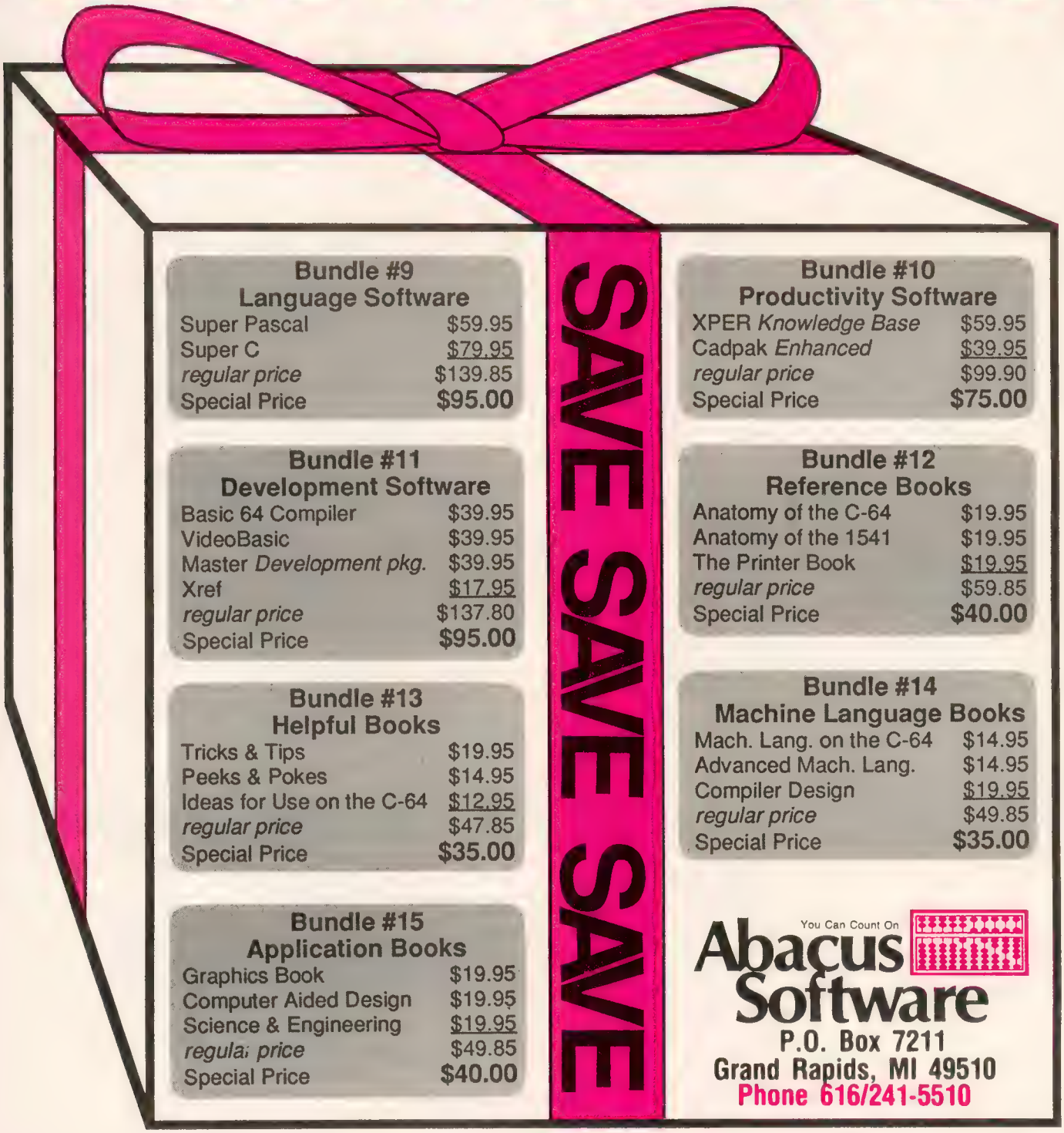

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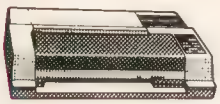

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The game gives you the option of playing against the computer (a tough challenge) or another person. You can select a regular three-period game or a penalty-shot competition in which you alternate between playing goalie and trying to score on the opposing team's goalie. Either mode of play allows you to choose from three levels of difficulty: beginner, medium, and expert. You control one player at a time by using the joystick, so good reflexes are a help. Even on the beginner level, the computer plays a tough game and you'll have to work hard to win.

Good graphics, crowd noise, the sound of the puck slapping against the stick, and the use of speech synthesis are attractive enhancements to *International Hockey*. You'll hear the announcer shout "He scores!" when you've just given up another goal to the opposing team.

Each period lasts for three minutes, and is filled with action as you scramble for the puck. Body checking is permitted, and you can take an opponent out of the play by knocking him down. But be warned, the officials are watching, and you may be penalized for excessive roughness. On higher levels of play, you may find after trying a body check that you're the one getting up while the opposition is homing in on your goal.

If you hit an opposing player too often, he may lose his temper, causing a fight. This could prove to be costly, as a penalty shot is awarded to each side. You might find yourself a goal down very quickly—the computer is tricky when it goes one-on-one. *International Hockey* is a fun way to fill those long winter nights when the hometown team is on the road.

—George Miller

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also worth noting

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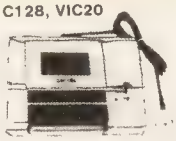

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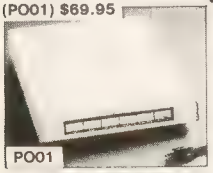

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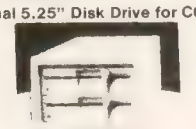

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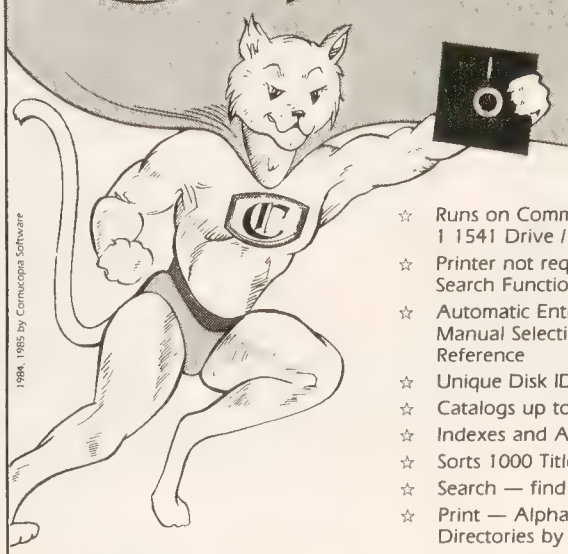

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simple answers to common questions

Tom R. Halfhill, Staff Editor

Each month, COMPUTE!'s GAZETTE *tackles some questions commonly asked by Commodore users and by people shopping for their first home computer. If you have a question you'd like to see answered here, send it to this column, c/o* COMPUTE!'s GAZETTE, *P.O. Box 5406, Greensboro, NC 27403.*

Q. I've read many articles in your magazine concerning the Commodore 64 and not being able to get a good 80-column screen with a composite color monitor. Why can't it be done? Also, Sony has announced a multiscan monitor, available in 13- and 20-inch screens. It displays pictures sent to it from a new TV component called a digital scan converter. The scan converter grabs two incoming scan lines, averages them to determine what a third line should look like, and then adds the new line between the original two for display. The result is a picture with twice as many lines—twice the normal resolution. Instead of showing 525 lines each 1/30 second, the screen displays 1,050. Would this type of TV/monitor not be ideal for the 64?

A. We've seen this Sony monitor at the last Consumer Electronics Show. It does indeed display a much sharper picture than normal TVs and monitors. However, we have yet to see one attached to a computer, so we aren't sure what the result would be. At this writing, the monitor isn't available in the U.S.

In any case, increasing the *vertical resolution* by adding extra scan lines does not address the problem of displaying 80-column text, which is mainly limited by the screen's *horizontal resolution.* To get an 80-column display with a 40-column Commodore 64, you must either add the video circuitry necessary to display twice as many pixels (screen dots) per horizontal line, or else split each 40-column character in two. The first method (used by plug-in video boards) strains the horizontal resolution of composite color monitors and TVs, because few are designed to sharply display that many pixels per line. The second method (used by "Screen-80," COMPUTE!'s GAZETTE, September 1984) displays 80 characters with the same number of pixels as 40 characters, so the effective resolution of each character is halved. Instead of 40 characters 8 pixels wide, there are 80 characters only 4 pixels wide. The number of pixels across remains constant at 320.

Although you can display 80 columns on a composite color monitor, or even a TV, the characters may not be sharp enough for extended use without eyestrain. Most people who spend many hours working with text displays (such as programmers and writers) prefer the sharpest possible screen. The most economical way to obtain a sharp 80-column screen with a Commodore 64 is to hook up a monochrome monitor. An alternative is to try using a color monitor with separate inputs for the luma and chroma signals, such as the rear connections on a Commodore 1701/1702.

Q. I've heard about printer buffers for printers, but I'm not exactly sure what they do. Is it true that they speed up your printer?

A. A printer buffer won't speed up your printer, but it can save you time whenever you have to use the printer.

Printer buffers help even out the tortoise-hare mismatch between printers and computers. Because printers are basically mechanical devices, their speed is very limited compared to computers. Most personal computer printers operate at less than 200 characters per second, even in their fastest modes. A computer, on the other hand, is easily capable of sending out thousands of characters per second.

To solve this problem, printer interfaces use a system called *handshaking.* In effect, the printer and computer constantly communicate with each other so the computer won't send characters faster than the printer can print them. This works fine, except that the computer must slow down to the speed of the printer. It might take five or ten minutes or more to print out a long program listing or document because the computer spends most of its time waiting for the printer to ask for more characters. Since you can't do anything else with the computer in the meantime, it slows you down to the speed of the printer, too.

A printer buffer keeps the printer from tying up the computer by providing a temporary storage area for the characters or graphics being printed. The buffer is a memory device that hooks up between the computer and printer and accepts output as fast as the computer can send it. Then it feeds the output from this reservoir to the printer at the printer's speed, freeing the computer to do other things.

Printer buffers are available with different amounts of memory. For maximum efficiency, a printer buffer should have enough memory to hold the largest file you're likely to print. For instance, if you're working with a word processor and frequently printing out documents about 30K long, you should consider a printer buffer with at least 30K of memory. Otherwise, the computer will still be tied up after the buffer fills.

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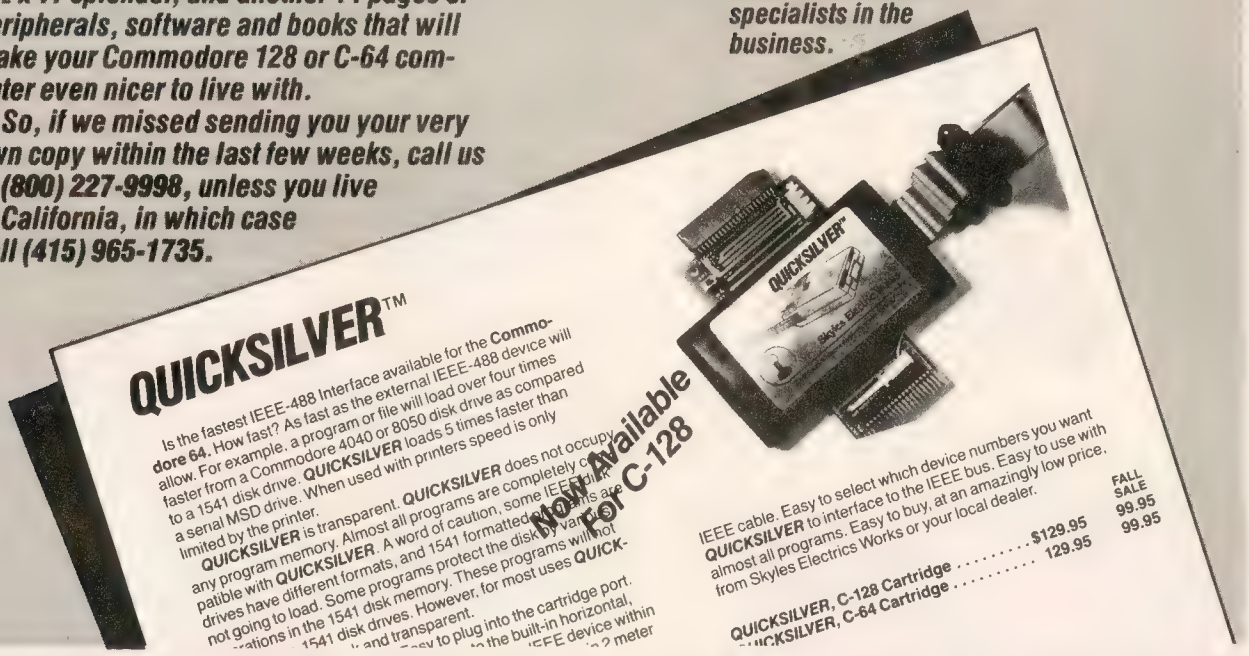
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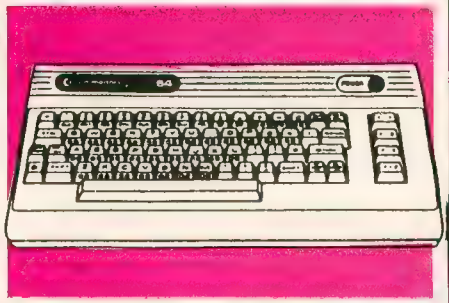

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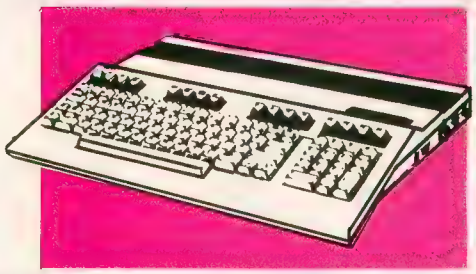

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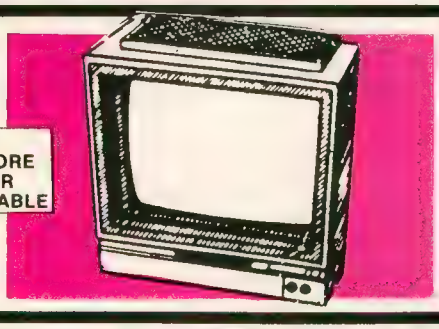

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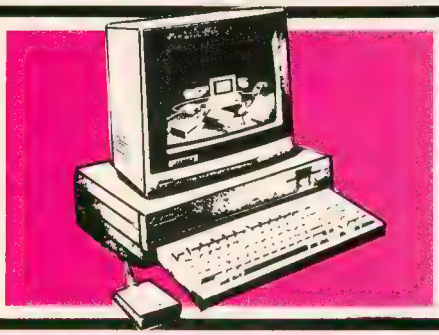

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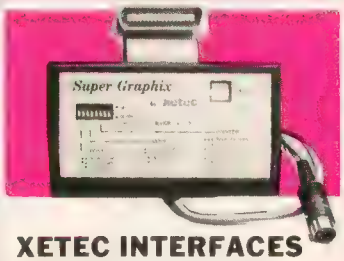

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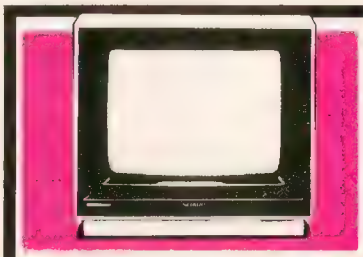

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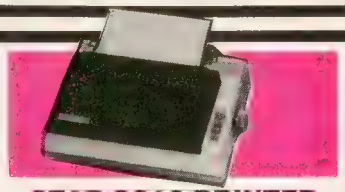

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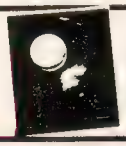

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The Talking Computer

Charles Brannon
Program Editor

Speech synthesis is fascinating. There's something gripping about a talking computer. Having used a computer, you begin to realize there's a whole world in there, but it has no name, no personality. When the computer talks, no matter how crudely, it somehow humanizes the machine. We already anthropomorphize things like our cars and pets. Adding a voice makes it all the more convincing.

More practically, speech helps bridge the communications gap between man and machine. The computer of the future will have sophisticated input devices. One day we'll be able to point to screen objects by looking at them, rather than pointing at them with some device or by moving a cursor on the screen. Tomorrow's computer may be able to understand speech, or, even better, lip-read. Indeed, some work is already in progress in these areas.

Eventually, our machines may be able to translate brain wave patterns into some usable form of input if we trust them to read our minds in even the most primitive fashion. But it's hard to imagine that speech will ever be outmoded as a practical form of communication. Although most of us can read faster than we can be read to, some form of intelligent speech will be built into most, if not all, future machines.

In fact, Commodore's Amiga has set a precedent by including voice synthesis as a standard. Programmers can use speech in their programs, confident that all users will be able to take advantage of it.

Affordable Speech

For a modest price, anyone can hook up a speech box and experiment with computer voice technology. Voice synthesizers have dropped in price as have so many other consumer computing products. Genesis Computer Corporation recently introduced the ProVoice, a $99 voice synthesizer for the Commodore 64 (or 128 in 64 mode). The ProVoice is a rather bulky cartridge that plugs into the expansion port (the cartridge doesn't seat very well, and tends to come unplugged). It adds voice synthesis commands to BASIC, making programming easier.

Hi-Tech Vernacular

The hallmark of the ProVoice is its excellent text-to-speech algorithms. With some synthesizers, you have to build up words from *phonemes*, the basic sounds of speech. Other synthesizers can only speak a limited memorized vocabulary. Still other synthesizers require you to record the sounds yourself with a microphone. Although ProVoice is a phoneme-based synthesizer, you need never program speech at such a low level (although the capability is available to you). Instead, the routines in the ProVoice cartridge translate ordinary English text into speech. It's as simple as entering SPEAK "HELLO" to get your computer talking.

The SPEAK command lets the ProVoice speak anything you can PRINT, including string and numeric variables. The speech is heard from a small speaker built into the ProVoice cartridge, separate from SID chip audio. The speech, like all phoneme-based synthesis, is robotic and monotonic, although you can insert pitch-change commands to simulate crude inflection. You also have control over nine volume levels.

Genesis claims a 95 percent accuracy rate for the text-to-speech algorithm, quite remarkable for a language as inconsistent as English. Of course, ProVoice can't tell the difference between *read* in the present tense ("reed") and *read* in the past tense ("red"). It follows English pronunciation rules as best it can, but it insists that *cough* rhymes with *bough*, and fails to realize that *house* rhymes with *mouse*. (*Mouse* comes out as "muss.") So, you sometimes need to intentionally misspell words, *photogruphy* for *photography*, or *scairce* for *scarce*. If you spell *fonetikly*, you can't go wrong.

Other commands (also programmed on the function keys) let you change the translation mode and toggle echo mode. The Conversational translation mode speaks most naturally. The Verbatim mode spells out symbols and pronounces control codes. The Character mode spells out everything, pronouncing words a letter at a time. You can also toggle a lowercase mode that causes ProVoice to either ignore shifted graphics or treat them as uppercase letters that should be pronounced.

The Echo mode is an especially handy feature. Anything printed to the screen is spoken in the current translation mode. ProVoice can read disk directories, data files, program listings, text from adventure games and utilities, even words spilling in from the modem. This is extremely useful for proofreading program listings—just have the computer read those tricky DATA statements to you. I even wrote a program to read *SpeedScript* files from disk.

If you need high-quality speech, phoneme-synthesis isn't ideal, but if you want the flexibility to be able to program any speech you like, there's no substitute.

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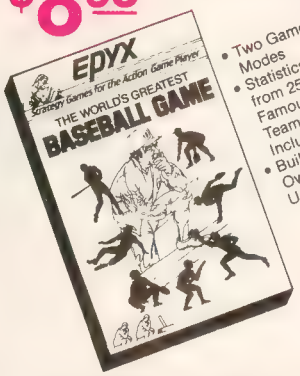

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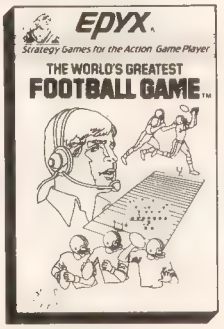

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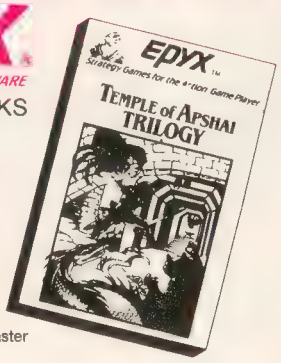

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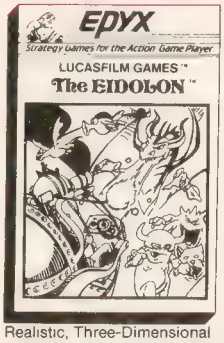

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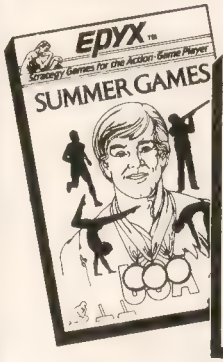

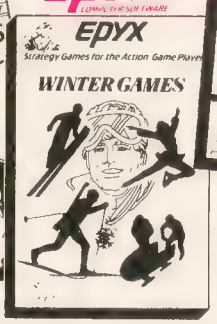

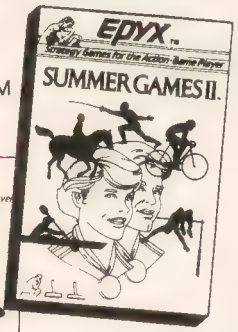

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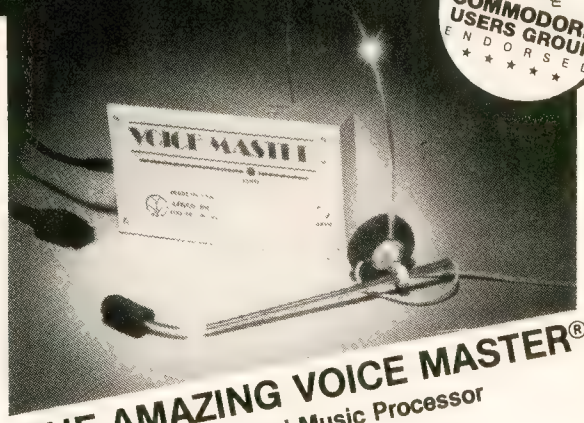

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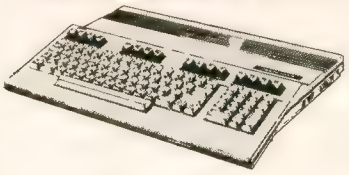

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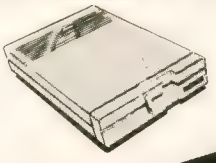

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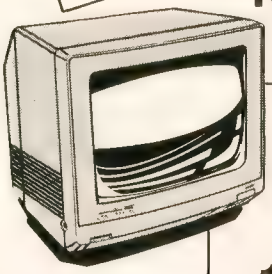

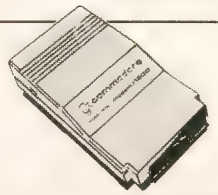

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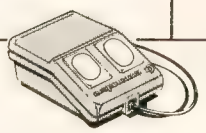

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Is Programming Dead?

Fred D'Ignazio
Associate Editor

Fred D'Ignazio is an associate editor of COMPUTE! *and* COMPUTE!'s GAZETTE. *He is a regular commentator on public TV's "Educational Computing" and on "The New Tech Times," a public TV program on consumer electronics. Fred's latest book is* Computing Together: A Parents and Teachers Guide to Using Computers with Young Children *(COMPUTE! Publications, 1984, $12.95).*

The Education Of Fred D'Ignazio

If you've followed my GAZETTE columns over the last two years, you've seen how often I've changed my thinking. Many of these changes have come from seeing new computer products and from talking to computer industry leaders. But most of the changes have come from listening to my readers. I credit you readers with the spirit and substance of many of my best GAZETTE columns. Despite appearances, these columns aren't the work of a single person. Rather, they are the collective product of all the readers who've taken the time to write me a letter.

Process Not Product

Over the past two years, in several of my columns, I've said that programming is dead. After writing these columns I expected to get letters from angry programmers who would defend programming as a ticket to a better job or a key to computer literacy.

I was wrong. Dozens of readers have argued in favor of the *process* of programming, not the product. For them programming is a form of *thinking*. They think of programming as a language, like English or mathematics, that they can use to express their thoughts and ideas. As a language for thoughts and ideas, they've said, programming is hardly dead.

Legos And Logo

Sometime after I received these letters, I had the opportunity to talk with John Kemeny and Tom Kurtz, the co-inventors of BASIC, and Seymour Papert, the creator of Logo. "Is programming dead?" I asked them. "Emphatically not!" they answered. Kemeny and Kurtz pointed out that programming has been a vital part of the liberal arts curriculum at Dartmouth College for the last 20 years. And Papert took me downstairs from his MIT office into a basement workshop to watch children who were using Logo to control machines, creatures, and vehicles they had made out of Lego building toys. "Logo is far from dead," said Papert. "These children are bringing Logo out of the computer into the real world."

Chasing Bees And Watching Stars

Shortly after I saw the MIT children's Lego-Logo contraptions, I attended the Logo '85 Conference at MIT, and the World Conference on Computers in Education, in Norfolk, Virginia. I heard teachers from all over the world describe how they and their children, like Papert's kids, were using programming to discover, describe, and control the real world. For example, one Japanese teacher and his children chased bees across hillsides, drew lines with Magic Markers across the backs of leaves, and watched the stars at night, then returned to the classroom and wrote Logo procedures to describe these "wondersome mechanisms of nature."

Programming As An End In Itself

I once was very excited about programming. But maybe I was excited for the wrong reasons—especially since those reasons have all disappeared. I thought that programming was a means to an end, and that end was software—programs that ran.

Now I'm not so sure. *Maybe programming is something more than just a means to create programs.* Maybe programming really is a form of thinking. Maybe it is an emerging medium for understanding and managing our machines, technology, and ever more complex world. If this is true, then we need to place a new emphasis on learning programming—this time for reasons that will endure the swift advances in computer technology.

What do *you* think? Please write me c/o *COMPUTE!'s Gazette, P. O. Box 5406, Greensboro, NC 27403.*

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machine language for beginners

Richard Mansfield
Senior Editor

What is machine language? I've seen 01001100 (in a textbook); 255,001,175 (in your magazine); 10 JSR 65484 (in your column).

These are different ways of representing ML. There are other ways you might see it printed too: 10 DATA 255,1,175 or 8000 20 D2 FF or 8000 JSR $FFD2.

At first it seems like an impossible mess, but it's really simple: All these listings are just different ways of saying the same thing. It's like any other language: Things can be said in a variety of ways.

For People Who Don't Know ML

You don't need to learn about most of these different representations. Two of them just make it easier for people who don't know ML to type in ML programs. They are for the convenience of magazine or book readers and aren't really an aspect of machine language.

The numbers 255,001,175 are a fragment of a listing which tells COMPUTE!'s "MLX" program how to generate a runnable ML program. MLX is our ML typing utility. It checks each line as it is entered and reports any errors. Similarly, ML can be listed in magazines as a series of DATA statements. This kind of listing is called a *BASIC loader* and a little loop in the loader POKEs each number into RAM when the loader is run, thus creating a finished ML program without the typist needing to understand anything about ML.

Other forms of "pseudo ML" are for studying; they're the equivalent of a program listing in BASIC. ML in the form of 8000 20 D2 FF or 8000 JSR $FFD2 appears on screen or on your printer when you use a special program called a *disassembler*. You give starting and ending addresses to a disassembler (since ML can start anywhere in RAM, you need to specify what part of memory you want disassembled).

Then the disassembler will print out the individual bytes of the program and their translation into ML *mnemonics* (instructions). It's usually a combination of bytes and translated instructions and looks like this: 8000 20 D2 FF JSR $FFD2. There are no line numbers here, but the address in RAM of this instruction serves much the same purpose: 8000. Then we have the three-byte package making up the instruction JSR with its *argument* $FFD2.

But what kind of numbers are D2 and FF? They're called *hexadecimal* or *hex*, symbolized by the $ sign. It's probably wise to start learning ML without worrying about hex. In some ways, hex is more convenient to use for advanced ML programming. But it's not for beginners and you can do anything you want in ML using ordinary decimal numbers. Likewise, that 01001100 you found in a textbook is yet another number system. It's called *binary*. Best not worry about that either until you're pretty well along in your understanding of ML. It, too, is always optional.

So, what is the real ML? How do you create an ML program? There are two stages: the code you write (source code) and the code the machine reads (object code). To understand this, it's helpful to realize that BASIC is also created in two stages: the code you write, like the instruction PRINT, and the code that ends up in RAM as your program, the runnable object code the computer can read and understand and act upon.

When you type 10 PRINT and press RETURN, your computer immediately transforms your source code (10 PRINT) into the numbers 10 0 153. The 10 0 is the line number, the 153 is the "token" (the symbol) for the instruction PRINT. Every BASIC command has its token and every line of BASIC you type in is automatically transformed from your human-readable source code into the machine-readable, tokenized, BASIC object code. Source code is easy to type in and easy to understand when it's LISTed. Object code is more compact and it's all numbers, the way the computer likes things.

The VIC and 64 are controlled by BASIC; it grabs control when you turn on the computer, and it lurks in the background no matter what you do. That's why you normally don't notice the two stages of writing a BASIC program—the object code is generated as soon as you press RETURN on each line. If they'd designed our computers to be governed by ML, things could work the same way: You could type in each line of ML source code and it could be translated (*assembled* is the technical term) into ML object code immediately.

As things are, you need to use an *assembler* to translate your ML source code into object code. In ML, two stages of creating a program are visible to the programmer. First you type in 10 JSR 65490 and any additional lines you want to include in the source code. Then, you activate your assembler. You have to obtain an assembler program; it's not built into a VIC or 64. The assembler creates the object code by reading through the entire source code and transforming each command into the appropriate ML object code.

Note that we used decimal in the example line above ($FFD2 would be that same number in hex). Unfortunately, some primitive assemblers offer you no choice: You must write your source code using hex. The more powerful and sophisticated assemblers, however, let you use either hex or decimal. That, and other programmer-friendly features, makes them more suitable for beginners to learn with.

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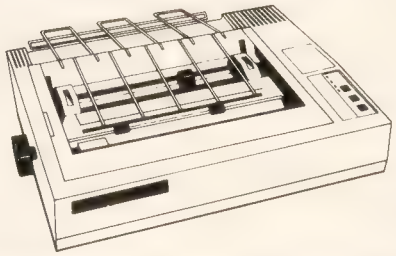

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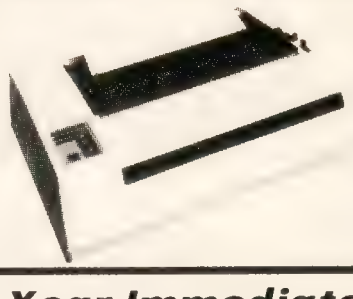

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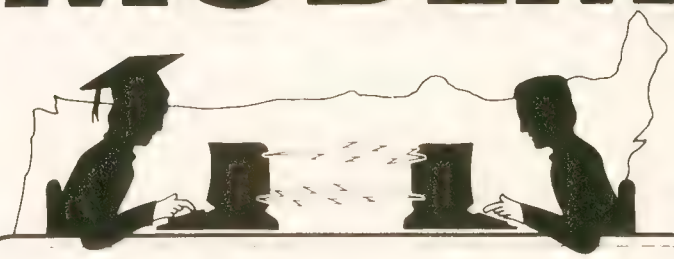

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BASIC magic

A Holiday Lesson For New Computer Owners

Michael S. Tomczyk

Computers are most fun at Christmas, so this month let's look at a potpourri of tips and tricks that owners of new computers will find helpful. Many of these are *not* explained very well in user manuals, which is why I'm including them here.

Erasing The Screen

One of the first things we do in most BASIC programs is clear (erase) the screen. To do this, type PRINT, a quotation mark, hold down SHIFT and press CLR/HOME (you should see a heart shape which represents the clear-screen character), then type another quotation mark, and press RETURN to enter the command:

```
PRINT"{CLR}"
```

This *erases* the screen. You can also add a message *inside* quotes, immediately after the clear command, and that message will appear at the top of your screen:

```
PRINT"{CLR}A CHRISTMAS
  PROGRAM"
```

Another way to clear the screen is to PRINT CHR$(147). (CHR$ is pronounced "character string.")

```
PRINT CHR$(147);"A NEW YEAR'S
  PROGRAM"
```

Notice that when using PRINT CHR$(147) you need to include a *semicolon*. This causes the message to appear on the first screen line. If you didn't use it, the message would appear on the second line. That's because every time you PRINT information on the screen, the computer automatically jumps down to the beginning of the next line. The semicolon prevents the computer from moving to the next line—in this sense the semicolon is like "programming glue."

Every character and editing function in your computer has its own CHR$ code—the codes are listed in the back of your user's manual. PRINTing one of these codes is the same as PRINTing the key or command itself.

There's a slight error in the CHR$ code chart found in the user's manual. CHR$(19) shows the CLR/HOME key in the chart but doesn't indicate whether the command is for CLEAR or HOME. CHR$(19) is the code for HOME. This command sends the cursor to the upper-left corner of the screen—called the "home" position—*without* erasing the screen. This is helpful for PRINTing long messages. Type in this program, then type RUN and press RETURN:

```
10 PRINT CHR$(147);
20 PRINT"MERRY CHRISTMAS..."
30 FOR T=1 TO 1000:NEXT
40 PRINT CHR$(19)"...AND HAPPY
   NEW YEAR!"
```

Let's examine this program line by line.

Line 10 clears the screen. We use a semicolon so the next message will appear on the top line. Line 20 PRINTs a message. Line 30 contains a very useful technique called a *time delay loop*. It uses a two-part command called FOR-NEXT to make the computer "count," and this delays the computer until it finishes counting. In this case, we told the computer to count to 1000. You can use a larger number to make the computer wait longer, or a smaller number for a shorter delay. Time delay loops are used to slow down programs.

Line 40 uses CHR$(19) to send the computer to the "home" position, then PRINTs the second message, "...HAPPY NEW YEAR!" This time we don't need a semicolon because the message is right after CHR$(19) in the same PRINT statement. In some cases you can omit the semicolon (if you're not sure, it doesn't hurt to leave it in).

Now type LIST and press RETURN. Your program automatically appears on the screen. You can use the cursor and INSerT/DELete keys to move around in the program and edit—insert and delete—commands. To make a change on any line, move the cursor to where you want to make the change, type the change, then press RETURN. The new program line will automatically replace the old one. Try this method to change "MERRY CHRISTMAS..." to "HAPPY HANUKKAH..." and then run the program to see the change.

Now, let's add a program line. LIST your program, type in this line, and press RETURN:

```
50 FOR T=1 TO 1000:NEXT:GOTO 10
```

REM: *If you haven't yet added line 50 to the program, try this. Type LIST and press RETURN. Line 30 looks almost exactly like this new line. Use the cursor up key to move the blinking cursor to the first character in line 30 and change the "3" to a "5". Now cursor right to the end of the line and add the colon, followed by GOTO 10, and press RETURN. If you LIST the program again, you'll find that line 30 is still there, and the new line 50 has been added. When you have several similar lines, you don't have to type each one. You can use the cursor controls to move around, change the line numbers, and save yourself a little typing.*

Now run the program. What did we do here? First, we put another *time delay loop* into the program. This causes the "HAPPY NEW YEAR" message to stay on the screen for a short time. Then we put a GOTO command at the end of the line. GOTO 10 tells the computer to "go to line 10." So the computer goes back to line 10 and keeps going back, over and over again until you stop it.

When a BASIC program keeps

going back and doing the same thing repeatedly, we say it's caught in an "endless loop." To break out of it, press the RUN/STOP key.

Using Variables

Variables are used in almost all programs. The letter T in our FOR-NEXT loop is a variable, for instance. We could have used any letter. I chose T to stand for "Time delay."

Variables like A, T, X, or AB, X3, P5, are called *numeric* variables because they stand for numbers. Variables like A$, T$, X$, or AB$, X3$, P5$ are called *string* variables ($ is pronounced "string"). They stand for letters, words, phrases, editing commands, and numbers not used in calculations (such as a social security number or address).

You can substitute a numeric variable for *any* number, and you can substitute a string variable for almost any group of letters, words, etc.

Type LIST and press RETURN. Now enter these lines:

```
15 M$="MERRY CHRISTMAS..."
20 PRINT M$
35 H$="...AND HAPPY NEW YEAR!"
40 PRINT CHR$(19) H$
```

Lines 15 and 35 will automatically be inserted in the appropriate place in our BASIC program. You can always add new lines just by typing them in. Lines 20 and 40 are replacement lines. They automatically replace the previous lines 20 and 40.

Type LIST to see the new program. It should look like this:

```
10 PRINT CHR$(147);
15 M$="MERRY CHRISTMAS..."
20 PRINT M$
30 FOR T=1 TO 1000:NEXT
35 H$="...AND HAPPY NEW YEAR!"
40 PRINT CHR$(19) H$
50 FOR T=1 TO 1000:NEXT:GOTO 10
```

This program works just like the previous one except we use string variables to display our messages. String variables are especially handy if you have to use a long message several times in your program. It's easier to define the message as a string variable and PRINT the variable instead of typing the message over and over.

Here's how our new program lines work:

Line 15 defines the variable M$ as "MERRY CHRISTMAS...". From now on, whenever M$ appears in this program, it's the same as "MERRY CHRISTMAS...". When you PRINT a variable, use the PRINT command and the variable *without* quotation marks. Line 35 is the same as line 15 except we use H$ to stand for "...AND HAPPY NEW YEAR!".

Line 40 PRINTs the HOME command followed by H$. Notice that you can put several different items after the same PRINT command. You can even PRINT several different variables next to each other, as in this example:

```
X$="HOLI":D$="DAY":PRINT X$;D$
```

Here's another quick tip concerning the semicolon. This information is usually hard for beginners to find. The VIC, Plus/4, and 16 allow only 88 characters on one program line and the 64 allows only 80. This limits the size of your messages. But what if you want to print a long paragraph or sentence? The way to do this is to link several messages together by using semicolons at the end of each PRINT statement. Here's an example.

To begin with, we'll work in upper/lowercase mode. There are two ways to put your computer in this mode. One way is to hold down the SHIFT and Commodore keys. (The Commodore key is in the lower-left corner.) The other way is to type PRINT CHR(14) and press RETURN. Either way, your computer works like a typewriter.

What you now type will be in lowercase, but commands will work just as they do when you type them in all capital letters. Type NEW and press RETURN to erase the previous program from the computer's memory, then try this example:

```
10 print chr$(147) chr$(14)
20 print"When in the course of human
   events, it becomes necessary for one
   peo";
30 print"ple to dissolve the political
   bands which have connected them
   with a";
40 print"nother, and to assume among
   the powers of the earth, the separate
   ";
50 print"and equal station to which the
   laws of nature and of nature's God
   en";
60 print"title them, a decent respect to
   the opinions of mankind requires
   tha";
70 print"t they should declare the causes
   which impel them to the separation."
80 print tab(6)"-Declaration of
   Independence"
```

Line 10 uses CHR$(147) to clear the screen. Then we print CHR$(14) to obtain upper/lowercase mode. If you want the display to start on the top line, add a semicolon at the end of the line. We also used the same PRINT command for two CHR$ codes by putting the codes next to each other as we did with the variables in our previous example.

Line 20 starts the message. (Capital letters are obtained by holding down SHIFT just as on a typewriter.) When we come to the end of the line, we cut the last word (people) and close the line with a quote and a semicolon. Lines 30–70 finish the message. Note that in some cases you have to leave a blank space at the beginning or end of a line.

When you're finished with this program, type NEW and press RETURN.

Numeric Variables

Let's look at a quick example that uses numeric variables.

```
10 A=5:B=10
20 PRINT A+B
```

In line 10 we define variables A and B, then in line 20 we add them and the computer displays the answer.

You can also use variables to count. For example, we know that the FOR-NEXT loop makes the computer count. That's how we create a time delay. We can also make the computer PRINT numbers being counted by the computer in the FOR-NEXT loop, like this:

```
10 FOR X=1 TO 100:PRINT X:NEXT X
```

Too fast, right? To slow it down, just insert a time delay loop. You can use more than one FOR-NEXT loop. In fact, you can use as many time delays as you need. Try this:

```
10 FOR X=1 TO 100:PRINT X:FOR T=1
   TO 200:NEXT T:NEXT X
```

This wraps up our Christmas package for this year. If you have a new computer under your tree, have fun and keep practicing your programming.

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

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User Group Update

When writing to a user group for information, please remember to enclose a stamped, self-addressed envelope.

Send typed additions, corrections, and deletions for this list to:

COMPUTE! Publications
P.O. Box 5406
Greensboro, NC 27403
Attn: Commodore User Groups

User Group Notes

The Payson Area Commodore Users Group has a new contact person: Larry Muhlestein, P.O. Box 525, Salem, UT 84653.

The new contact person and address for the 20/64 Computer Users Group are Robert Simpson, P.O. Box 18788, San Jose, CA 95158-8788.

The Annapolis Commodore User's Group can now be reached at P.O. Box 3358, Annapolis, MD 21403.

The Narragansett Commodore Users Group has a new address and contact person: Kenneth Gaspar, P.O. Box 8707, Cranston, RI 02920.

The new address for the Bowling Green State University User Group is c/o Chris Hunt, 1451 Clough St., Bowling Green, OH 43402.

Plus/4 owners can now join a national user group called PLUG (Plus/4 Users' Group). Write Calvin Demmon, Box 1001, Monterey, CA 93940.

The correct address and contacts for the Dungeons and Dragons User's Group are: Glenn Halliburton and Ronnie Hastings, Rt. 1, Box 28A, Cumberland City, TN 37050.

New Listings

CALIFORNIA

Concord Area Commodore Enthusiasts (C.A.C.E.), Tim Schreiber, 4861 Boxer Blvd., Concord, CA 94521

Madera Users Group (MUG), P.O. Box 783, Madera, CA 93639

C-TUG Orange County, c/o Syntax Error, P.O. Box 8051, Orange, CA 92664

Monterey Peninsula Commodore Group, P.O. Box 2105, Seaside, CA 93955

64/20 Club, Greg Burns, 6464 Shearwater St., Ventura, CA 93003

CONNECTICUT

Interface 64, Brian Targonsky, Plains Rd., Haddam, CT 06438

ILLINOIS

Southern Illinois Commodore User Group, 508 W. Collins, Goreville, IL 62939

KENTUCKY

Logan County Commodore Users Club, Larry McDowell, P.O. Box 302, Lewisburg, KY 42256

MICHIGAN

64 Trident Software Club, Kevin Ballast, 7416 Westwood Dr., Jenison, MI 49428

Kalamazoo Valley Home Users Group, P.O. Box 3085, Kalamazoo, MI 49003

MINNESOTA

Central Minnesota Computer Users Group (CMCUG), David C. Hunt, 217 Riverside Ave. S, Sartell, MN 56377

MISSOURI

Heartland User's Group, Box 1251, Cape Girardeau, MO 63701

NEW JERSEY

NJ Commodore/Apple Computer Users Group, Emilio Garcia, 60 Devonshire Ct., Middletown, NJ 07748

Tri-County 64-User Group, 22 Jackson Village, Rutherford, NJ 07070

Commodore Crew User Group (C.C.U.G.) 304 Born St., Secaucus, NJ 07094

OHIO

Commodore Hammondsville Users Group of Ohio (C.H.U.G.O.), Randy Zimmer, P.O. Box 7, S.R. 213, Hammondsville, OH 43930

Cincinnati Commodore Computer Club, Wally Jones, Box 450, Owensville, OH 45160

PENNSYLVANIA

Lehigh Valley Medical Center, Thomas Duff, 3159 Middletown Rd., Bethlehem, PA 18017

Central Area Bulletin Board Systems (C.A.B.B.S.) User Group, Dave Warden, 4205 Ridgeview Rd., Harrisburg, PA 17112

TENNESSEE

Commodore Association South East (C.A.S.E.), P.O. Box 110386, Nashville, TN 37211

Nashville Commodore User Group, Joe Fetherling, P.O. Box 121282, Nashville, TN 37212

TEXAS

Business Interface Languages Limited (B.I.L.L.), P.O. Box 592, Adkins, TX 78101

VIRGINIA

Shenandoah Valley Commodore Users Group, Mary Habecker, 701 Butler Ave., Winchester, VA 22601

WASHINGTON

64 E/T, Don Winder, 127-182 Pl. SW, Bothell, WA 98012

WEST VIRGINIA

The 128 Society, 17 Silo Square, Lewisburg, WV 24901

WISCONSIN

Clintonville Area Commodore 64s True User Support (C.A.C.T.U.S.), Ethan Schoonover, 56 Pearl St., Clintonville, WI 54929

bug-swatter

Modifications and Corrections

● On the September Gazette Disk, each custom character set for "Printer Wedge" included a message reminding users to merge the character set with the main program. If you don't have a merging utility, like "MetaBASIC," you can follow these directions to merge the character sets:

1. Load but don't run the main program for Printer Wedge. Delete line 10000 (type **10000** and press RETURN).

2. Enter **EB = PEEK(45) + PEEK (46) * 256 − 2: POKE43, EB AND 255: POKE 44, INT(EB/256): NEW**.

3. Load the character set you wish to add (for example, **LOAD "0:CSET3" ,8**) and add the line: **10000 DATA 0** (the DATA statement must always be a zero).

4. Type **POKE 43,1: POKE 44,8**.

5. Save the merged program, if you wish, and run it. Press f2 to install the new character set.

Also, some readers have had difficulties using Printer Wedge with *SpeedScript*. The two programs are compatible, but disk users must install the wedge at either 854 or 679. Tape users must select location 679 only. Don't press RUN/STOP–RESTORE; it disables the wedge. Follow these steps to use the two programs:

1. Load and run Printer Wedge.

2. Assign it to location 854 (679 for cassette).

3. Load and run *SpeedScript* without pressing RUN/STOP–RESTORE.

Finally, as noted in the article, if you want to use the custom characters to list a program to the printer, you should list to disk first. Here are step-by-step instructions:

1. Enable Printer Wedge and load the program to be listed.

2. **OPEN 1,8,2,"ASCIIFILE,S,W": CMD 1: LIST** to create a sequential ASCII file.

3. When the program has finished listing, **PRINT#1: CLOSE 1**.

4. Enter and run this program:

```
1 OPEN 1,8,2,"ASCIIFILE,S,R"
2 OPEN 4,4,7
3 GET#1,A$
4 IF (64 AND STATUS)=0 THEN
  PRINT#4,A$;: GOTO 3
5 CLOSE 1: PRINT#4: CLOSE 4
```

● The last part of line 240 in the 64 version of "Atom Shoot" (October) was accidentally cut off. The game runs as published, but it won't keep track of the correct number of guesses. Here's the correct line 240:

```
240 PRINTDN$"{73}"B"{LEFT} PTS
    {SPACE}{2 DOWN}{6 LEFT}
    {6 SPACES}":G=G+1    :rem 2
```

● "Turnabout" (October) runs as listed, but on level three the bonus timer counts down too quickly. To fix it, load and run MLX. The starting address is the same (49152), but the new ending address should be 51577. Use SHIFT-L to load Turnabout from tape or disk. Next, type SHIFT-N to enter a new line at 49329:

```
49329 :076,110,201,201,255,208,204
```

Next, enter SHIFT-N to correct two lines, beginning with 51566:

```
51566 :206,061,201,173,061,201,245
51572 :076,180,192,000,000,008,060
```

When the corrections have been made, type SHIFT-S to save to disk or tape.

● Readers who typed in "VIC Emulator" (September) to play the VIC-20 game "Enchanted Journey" (May) on their 64s may have been disappointed to find that the joystick routine does not read movement to the right. The following lines will correct the joystick routine:

```
82 POKE36869,205:SYS832:MA=0:M
   B=0:IFPEEK(830)=0AND(PEEK(3
   71)52)=128)THEN241    :rem 46
84 IF(PEEK(371)52)<>128)THENMA=
   1:IFCK=9THENMA=-1:GOTO87
                         :rem 11
```

Load VIC Emulator into your 64, run it, then load Enchanted Journey and make the changes above to Program 3.

● "Gradebook" (October) has no flaws that we're aware of. As noted in the article, when Gradebook is first loaded you should clear the workspace by typing SHIFT–CLR/ HOME. Also, you must enter the highest possible test score (a perfect mark) at the top of each column before starting to type individual grades. And, of course, you should turn on the printer before you give the command to print out the grades.

Some teachers have suggested adding an option to print out each student's grades. Parents could then be given a list of their child's marks, rather than seeing a complete list of all the students and their grades. The following program prints all the grades for an individual student:

```
100 IFATHEN130          :rem 36
110 INPUT"{CLR}{4 DOWN} GRADEB
    OOK FILENAME ";N$ :rem 185
120 A=1:LOADN$,8,1     :rem 207
130 OPEN4,4            :rem 90
140 S=16896:PRINT"{CLR}
    {4 DOWN}{2 SPACES}STUDENT
    {SPACE}NAME OR £ FOR ALL
    {SPACE}STUDENTS"  :rem 148
150 PRINTSPC(12)"[Q] TO QUIT":
    INPUT"{DOWN}{2 SPACES}";SN
    $:IFSN$="Q"THENCLOSE4:END
                         :rem 89
160 IF(PEEK(S)AND223)=0THENPRI
    NT"{DOWN}DONE":FORI=1TO100
    0:NEXT:GOTO140      :rem 11
170 FORA=25984TO26083:IFPEEK(A
    )=201THENB=A-25984:A=26083
                         :rem 226
180 NEXT:IFSN$="£"THEN240
                          :rem 8
190 IFPEEK(S)+64<>ASC(LEFT$(SN
    $+CHR$(0),1))THENS=S+128:G
    OTO160              :rem 122
200 IFLEN(SN$)=1THEN240:rem 73
210 FORA=2TOLEN(SN$)   :rem 194
220 IFASC(MID$(SN$,A,1)+CHR$(0
    ))<>PEEK(S+A-1)+64THENS=S+
    128:GOTO160         :rem 90
230 NEXT               :rem 212
240 FORA=0TO18:Q=PEEK(S+A):PRI
    NT#4,CHR$(Q+64+64*(Q=32));
    :NEXT:PRINT#4:PRINT#4
                         :rem 169
250 FORA=1TOB:PRINT#4,"ASSIGNM
    ENT#:"A;"PERFECT:"PEEK(259
    83+A);                :rem 33
260 PRINT#4,"WEIGHT:"PEEK(2623
    9+A);"MARK: ";       :rem 245
270 IFPEEK(S+19+A)=201THENPRIN
    T#4,"*":GOTO290     :rem 125
280 PRINT#4,PEEK(S+19+A)
                         :rem 116
290 NEXT:S=S+128:FORA=1TO5:PRI
    NT#4:NEXT:IFSN$="£"THENGO
    TO160               :rem 102
300 GOTO140              :rem 97
```

Tape users should change the 8 in line 120 to a 1. To adjust the printer's spacing, increase or decrease the 5 in line 290. After saving a Gradebook file to tape or disk, load and run the program above. Enter a student's name or type £ (the English-pound sign, left of the CLR/HOME key) to print the grades of the entire class.

How To Type In *COMPUTE!'s GAZETTE* Programs

Each month, COMPUTE!'s GAZETTE publishes programs for the Commodore 128, 64, Plus/4, 16, and VIC-20. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then back on, erasing whatever was in memory. So be sure to *save a copy of your program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT} and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

The Automatic Proofreader

Charles Brannon, Program Editor

"The Automatic Proofreader" will help you type in program listings from COMPUTE!'s GAZETTE without typing mistakes. It is a short error-checking program that hides itself in memory. When activated, it lets you know immediately after typing a line from a program listing if you have made a mistake. Please read these instructions carefully before typing any programs in COMPUTE!'s GAZETTE.

Preparing The Proofreader

1. Using the listing below, type in the Proofreader. The same program works on both the VIC-20 and Commodore 64. Be very careful when entering the DATA statements—don't type an l instead of a 1, an O instead of a 0, extra commas, etc.

2. Save the Proofreader on tape or disk at least twice *before running it for the first time.* This is very important because the Proofreader erases this part of itself when you first type RUN.

3. After the Proofreader is saved, type RUN. It will check itself for typing errors in the DATA statements and warn you if there's a mistake. Correct any errors and save the corrected version. Keep a copy in a safe place—you'll need it again and again, every time you enter a program from COMPUTE's GAZETTE.

4. When a correct version of the Proofreader is run, it activates itself. You are now ready to enter a program listing. If you press RUN/STOP—RESTORE, the Proofreader is disabled. To reactivate it, just type the command SYS 886 and press RETURN.

Using The Proofreader

All VIC and 64 listings in COMPUTE!'s GAZETTE now have a *checksum number* appended to the end of each line, for example ":rem 123". *Don't enter this statement when typing in a program.* It is just for your information. The rem makes the number harmless if someone does type it in. It will, however, use up memory if you enter it, and it will confuse the Proofreader, even if you entered the rest of the line correctly.

When you type in a line from a program listing and press RETURN, the Proofreader displays a number at the top of your screen. *This checksum number must match the checksum number in the printed listing.* If it doesn't, it means you typed the line differently than the way it is listed. Immediately recheck your typing. Remember, don't type the rem statement with the checksum number; it is published only so you can check it against the number which appears on your screen.

The Proofreader is not picky with spaces. It will not notice extra spaces or missing ones. This is for your convenience, since spacing is generally not important. But occasionally proper spacing *is* important, so be extra careful with spaces, since the Proofreader will catch practically everything else that can go wrong.

There's another thing to watch out for: if you enter the line by using abbreviations for commands, the checksum will not match up. But there is a way to make the Proofreader check it. After entering the line, LIST it. This eliminates the abbreviations. Then move the cursor up to the line and press RETURN. It should now match the checksum. You can check whole groups of lines this way.

Special Tape SAVE Instructions

When you're done typing a listing, you must disable the Proofreader before saving the program on tape. Disable the Proofreader by pressing RUN/STOP–RESTORE (hold down the RUN/STOP key and sharply hit the RESTORE key). This procedure is not necessary for disk SAVEs, *but you must disable the Proofreader this way before a tape SAVE.*

SAVE to tape erases the Proofreader from memory, so you'll have to load and run it again if you want to type another listing. SAVE to disk does not erase the Proofreader.

Since the Proofreader is a machine language program stored in the cassette buffer, it will be erased during a tape SAVE or LOAD. If you intend to type in a program in more than one sitting or wish to make a safety SAVE, follow this procedure:

1. **Load and run the Proofreader.**
2. **Disable it by pressing RUN/STOP–RESTORE.**
3. **Type the following two lines in direct mode (without line numbers):**

```
A$="PROOFREADER.T":FORX=1TO40:A$=A$+" ":NEXT
FORX=886TO1018:A$=A$+CHR$(PEEK(X)):NEXT:OPEN1,1,1,A$:CLOSE1
```

After you type the last line, you will be asked to press RECORD and PLAY. We recommend you start at the beginning of a new tape.

You now have a new version of the Proofreader (PROOFREADER.T, as renamed in the above code). Turn your computer off and on, then load the program you were working on. Put the cassette containing PROOFREADER.T into the tape unit and type:

```
OPEN1:CLOSE1
```

You can now get into the Proofreader by typing SYS 886. To test this, PRINT PEEK (886) should return the number 173. If it does not, repeat the steps above, making sure that A$ (PROOFREADER.T) contains 13 characters.

The new version of Automatic Proofreader will load itself into the cassette buffer whenever you type OPEN1: CLOSE1 and PROOFREADER.T is the next program on your tape. It will not disturb the contents of BASIC memory.

The above code converts the machine language program into characters that are concatenated into a string. When you open a tape file, using the string as the name of the file, the tape header contains the machine language program (disguised as part of the filename). Opening and closing the tape file loads the header into the cassette buffer, but does not disturb BASIC programs already in memory.

Automatic Proofreader For VIC And 64

```
10 PRINT"{CLR}PLEASE WAIT...":FOR
   I=886TO1018:READA:CK=CK+A:POKE
   I,A:NEXT
20 IF CK<>17539 THEN PRINT"{DOWN}
   YOU MADE AN ERROR":PRINT"IN DA
   TA STATEMENTS.":END
30 SYS886:PRINT"{CLR}{2 DOWN}PROO
   FREADER ACTIVATED.":NEW
40 DATA 173,036,003,201,150,208
50 DATA 001,096,141,151,003,173
60 DATA 037,003,141,152,003,169
70 DATA 150,141,036,003,169,003
80 DATA 141,037,003,169,000,133
90 DATA 254,096,032,087,241,133
100 DATA 251,134,252,132,253,008
110 DATA 201,013,240,017,201,032
120 DATA 240,005,024,101,254,133
130 DATA 254,165,251,166,252,164
140 DATA 253,040,096,169,013,032
150 DATA 210,255,165,214,141,251
160 DATA 003,206,251,003,169,000
170 DATA 133,216,169,019,032,210
180 DATA 255,169,018,032,210,255
190 DATA 169,058,032,210,255,166
200 DATA 254,169,000,133,254,172
210 DATA 151,003,192,087,208,006
220 DATA 032,205,189,076,235,003
230 DATA 032,205,221,169,032,032
240 DATA 210,255,032,210,255,173
250 DATA 251,003,133,214,076,173
260 DATA 003
```

MLX Machine Language Entry Program For Commodore 64

Charles Brannon, Program Editor

MLX is a labor-saving utility that allows almost fail-safe entry of machine language programs published in COMPUTE!'s GAZETTE. You need to know nothing about machine language to use MLX—it was designed for everyone.

MLX is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file. You can then use the LOAD command to read the program into the computer, as with any program:

LOAD "filename" (for tape)
LOAD "filename",8,1 (for disk)

To start the program, you enter a SYS command that transfers control from BASIC to machine language.The starting SYS number always appears in the appropriate article.

Using MLX

Type in and save MLX (you'll want to use it in the future). When you're ready to type in an ML program, run MLX. MLX asks you for two numbers: the starting address and the ending address. These numbers are given in the article accompanying the ML program.

You'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers—six actual data numbers plus a *checksum number.* The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. If you make a typing error, press the INST/DEL key; the entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer automatically prints the comma and goes on to accept the next number. If you enter less than three digits, you can press either the SPACE bar or RETURN key to advance to the next number. The checksum automatically appears in inverse video for emphasis.

To simplify your typing, MLX redefines part of the keyboard as a numeric keypad:

```
  U I O              7 8 9
H J K L  become   0  4 5 6
  M , .              1 2 3
```

MLX Commands

When you finish typing an ML listing (assuming you type it all in one session) you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you've made a typo when entering the MLX program itself.

You don't have to enter the whole ML program in one sitting. MLX lets you enter as much as you want, save it, and then reload the file from tape or disk later.

MLX recognizes these commands:

SHIFT-S: Save SHIFT-N: New Address
SHIFT-L: Load SHIFT-D: Display

When you enter a command, MLX jumps out of the line you've been typing, so we recommend you do it at a new prompt. Use the Save command to save what you've been working on. It will save on tape or disk, as if you've finished, but the tape or disk won't work, of course, until you finish the typing. Remember what address you stop at. The next time you run MLX, answer all the prompts as you did before, then insert the disk or tape. When you get to the entry prompt, press SHIFT-L to reload the partly completed file into memory. Then use the New Address command to resume typing.

To use the New Address command, press SHIFT-N and enter the address where you previously stopped. The prompt will change, and you can then continue typing. Always enter a New Address that matches up with one of the line numbers in the special listing, or else the checksum won't work. The Display command lets you display a section of your typing. After you press SHIFT-D, enter two addresses within the line number range of the listing. You can abort the listing by pressing any key.

What if you forgot where you stopped typing? Use the Display command to scan memory from the beginning to the end of the program. When you reach the end of your typing, the lines will contain a random pattern of numbers. When you see the end of your typing, press any key to stop the listing. Use the New Address command to continue typing from the proper location.

See program listings on page 160.

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Auto Time And Date

Article on page 94.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
100 CK=56328:SA=49155:REM SA I
    S ML STARTING ADDRESS
                        :rem 208
110 FORI=SATOSA+151:READA:X=X+
    A:POKEI,A:NEXTI     :rem 151
120 IFX<>16817THENPRINT"ERROR
    {SPACE}IN DATA STATEMENTS.
    ":STOP              :rem 236
130 PRINT"{CLR}":A=SA+137:POKE
    SA+13,A-INT(A/256)*256:POK
    ESA+14,INT(A/256)   :rem 66
140 POKESA+145,A-INT(A/256)*25
    6:POKESA+146,INT(A/256)
                        :rem 255
150 POKESA+36,SA-INT(SA/256)*2
    56:POKESA+37,INT(SA/256)
                        :rem 151
160 PRINT"TODAY'S DATE (MM/DD/
    YY, IE. 07/01/85)":INPUT D
    A$                  :rem 242
170 IFLEN(DA$)<>8THENPRINT"
    {DOWN}ERROR IN DATE ENTRY.
     TRY AGAIN!{DOWN}":GOTO160
                        :rem 93
180 PRINT"{DOWN}PRESENT TIME (
    HHMM FORMAT, IE. 0935)":IN
    PUTTM$              :rem 87
190 IFLEN(TM$)=4ANDVAL(TM$)<=1
    259THEN210          :rem 103
200 PRINT"{DOWN}ERROR IN TIME
    {SPACE}ENTRY. TRY AGAIN!
    {DOWN}":GOTO180     :rem 33
210 PRINT:INPUT"AM OR PM (
    {RVS}A{OFF}/{RVS}P{OFF})";
    A$:IF A$<>"A" AND A$<>"P"
    {SPACE}THEN 210     :rem 40
220 TM$=TM$+"00":B=0:IF A$="P"
     THEN B=128         :rem 91
230 PRINT"{CLR}TODAY'S DATE: "
    ;DA$:PRINT          :rem 247
240 PRINT"PRESENT TIME: ";LEFT
    $(TM$,2);":";MID$(TM$,3,2)
    ;" ";A$;"M"         :rem 159
250 PRINT:PRINT:INPUT"ARE THES
    E CORRECT (Y/N){2 SPACES}Y
    {3 LEFT}";A$        :rem 83
260 IFA$="N"THENPRINT"{CLR}":G
    OTO160              :rem 248
270 FORT=1TO8:POKESA+T,ASC(MID
    $(DA$,T,1)):NEXTT:IFLEFT$(
    TM$,2)="12"THENB=128-B
                        :rem 183
280 FORA=1TO5STEP2:D=VAL(MID$(
    TM$,A,1)):D=D*16+VAL(MID$(
    TM$,A+1,1))         :rem 108
290 IFA=1THEND=DORB     :rem 176
300 POKECK+3-(A-1)/2,D:NEXTA:P
    OKECK,0             :rem 169
310 POKESA+142,PEEK(818):POKES
    A+143,PEEK(819)     :rem 96
320 REM GET ISAVE VECTOR ADDR
    {SPACE}AND SAVE TO EXIT IN
     ML                 :rem 206
330 A=SA+15:POKE818,A-INT(A/25
    6)*256:POKE819,INT(A/256)
                        :rem 109
340 REM POINT ISAVE VECTOR TO
    {SPACE}START OF ML:rem 175
350 POKESA+150,PEEK(774):POKES
    A+151,PEEK(775)     :rem 100
360 REM GET IQPLOP (LIST) VECT
    OR ADDR AND SAVE TO EXIT I
    N ML                :rem 188
370 A=SA+11:POKE774,A-INT(A/25
    6)*256:POKE775,INT(A/256)
                        :rem 111
380 REM POINT IQPLOP (LIST) VE
    CTOR TO START OF ML
                        :rem 157
390 NEW                 :rem 134
400 DATA 32,48,48,47,48,48,47,
    48,48,32,0          :rem 190
410 DATA 8,238,197,3,72,138,72
    ,152,72,162,0       :rem 72
420 DATA 160,4,177,43,201,143,
    208,102,200         :rem 203
430 DATA 177,43,240,97,189,60,
    3,240,5,145         :rem 233
440 DATA 43,232,208,241,162,2,
    177,43,240          :rem 168
450 DATA 78,189,9,220,41,127,7
    4,74,74,74          :rem 200
460 DATA 9,48,145,43,200,177,4
    3,240,60            :rem 78
470 DATA 189,9,220,41,15,9,48,
    145,43,202          :rem 181
480 DATA 240,12,200,177,43,240
    ,43,169,58          :rem 177
490 DATA 145,43,200,208,210,20
    0,169,32            :rem 66
500 DATA 145,43,200,173,11,220
    ,48,5,169           :rem 116
510 DATA 65,208,3,234,169,80,1
    45,43,200           :rem 124
520 DATA 169,77,145,43,200,177
    ,43,240,6           :rem 132
530 DATA 169,32,145,43,208,245
    ,173,8,220          :rem 180
540 DATA 104,168,104,170,169,0
    ,208,4,104          :rem 167
550 DATA 76,0,0,206,197,3,104,
    40,76,0,0           :rem 107
```

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Disk File Archiver

See instructions in article on page 93 before typing in.

```
49152 :011,008,158,050,048,054,073
49158 :049,169,010,141,130,002,251
49164 :032,024,008,076,148,227,015
49170 :162,076,160,008,142,050,104
49176 :003,140,051,003,096,032,093
49182 :207,255,032,207,255,169,131
49188 :013,032,210,255,032,207,017
49194 :255,072,032,210,255,104,202
49200 :201,013,208,244,032,104,082
49206 :009,162,128,108,003,169,121
49212 :160,160,009,032,030,171,110
49218 :076,058,008,165,187,133,181
49224 :002,165,188,133,003,165,216
49230 :183,133,004,032,237,245,144
49236 :169,032,189,255,032,087,080
49242 :009,032,207,255,201,050,076
49248 :176,003,076,058,008,201,106
49254 :054,208,178,032,207,255,012
49260 :201,051,208,174,032,207,213
49266 :255,201,013,208,249,032,048
49272 :104,009,169,032,160,039,121
49278 :153,060,003,136,016,250,232
49284 :164,004,192,011,176,176,087
49290 :136,177,002,153,063,003,160
49296 :153,078,003,136,016,245,007
49302 :169,046,141,073,003,141,211
49308 :088,003,169,052,141,074,171
49314 :003,160,002,185,136,009,145
49320 :153,060,003,136,016,247,015
49326 :169,015,162,060,160,003,231
49332 :032,189,255,032,087,009,016
49338 :032,104,009,160,002,185,166
49344 :133,009,153,060,003,153,191
49350 :075,003,136,016,244,169,073
49356 :061,141,075,003,169,052,193
49362 :141,074,003,133,254,169,216
49368 :051,141,089,003,169,030,187
49374 :162,060,160,003,032,189,060
49380 :255,032,087,009,032,207,082
49386 :255,201,050,144,002,198,060
49392 :254,032,104,009,032,113,016
49398 :009,206,074,003,206,089,065
49404 :003,173,089,003,201,048,001
49410 :208,216,169,032,141,088,088
49416 :003,141,089,003,165,004,157
49422 :024,105,018,162,060,160,031
49428 :003,032,189,255,032,087,106
49434 :009,032,104,009,169,133,226
49440 :157,169,139,160,009,032,186
49446 :030,171,165,254,032,210,132
49452 :255,169,002,168,162,008,040
49458 :032,186,255,165,004,162,086
49464 :063,160,003,032,189,255,246
49470 :169,043,166,045,164,046,183
49476 :032,216,255,169,128,133,233
49482 :157,076,091,008,169,015,078
49488 :162,008,168,032,186,255,123
49494 :032,192,255,162,015,032,006
49500 :198,255,096,169,015,032,089
49506 :195,255,032,204,255,096,111
49512 :169,032,189,255,032,087,100
49518 :009,032,207,255,201,013,059
49524 :208,249,032,104,009,096,046
49530 :082,048,058,083,048,058,243
49536 :013,145,082,069,078,065,068
49542 :077,069,029,029,029,029,140
49548 :029,029,029,029,029,029,058
49554 :029,046,013,070,073,076,197
49560 :069,078,065,077,069,032,030
49566 :084,079,079,032,076,079,075
49572 :078,071,013,013,013,013,109
```

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Soundpix

Article on page 86.

```
10 DIMW(84),X(84):POKE53280,12
   :POKE53281,0:PRINTCHR$(147)
   CHR$(5)              :rem 142
20 X1=170:X2=250:Y1=105:Y2=Y1+
   21:Y3=Y2+21:Y4=Y3+21:Q=1228
   8:Q1=12801:V=53248:C=2
                        :rem 196
30 E=54299:F=54300:D=32:A=.5:O
   =1:I=2:S=3:T=0:E$="
   {12 SPACES}"         :rem 235
40 FORT=54272TO54295:POKET,0:N
   EXT:POKE54296,143:FORT=QTO1
   2798:POKET,0:NEXT    :rem 152
```

```
50 FORT=2040TO2047:POKET,T-184
   8:NEXT                  :rem 203
60 POKEV,X1:POKEV+1,Y1:POKEV+2
   ,X1:POKEV+3,Y2:POKEV+4,X1:P
   OKEV+5,Y3:POKEV+6,X1
                           :rem 149
70 POKEV+7,Y4:POKEV+8,X2:POKEV
   +9,Y1:POKEV+10,X2:POKEV+11,
   Y2:POKEV+12,X2          :rem 191
80 POKEV+13,Y3:POKEV+14,X2:POK
   EV+15,Y4                :rem 66
90 FORT=39TO42:POKEV+T,3:NEXT:
   FORT=43TO46:POKEV+T,7:NEXT
                           :rem 172
100 POKEV+23,0:POKEV+29,255
                           :rem 31
110 POKE54273,10:POKE54287,6
                           :rem 40
120 A$="":POKE214,C+1:PRINT:PO
   KE211,2:INPUT"WAVEFORM";A$
   :GOSUB560:IFU=0THEN120
                           :rem 29
130 W=VAL(A$):IFW=0ORW>255THEN
   120                     :rem 226
140 IFW=65THENGOSUB530:rem 106
150 A$="":POKE214,C+2:PRINT:PO
   KE211,2:INPUT"ATT/DEC";A$:
   GOSUB560:IFU=0THEN150
                           :rem 161
160 AD=VAL(A$):IFAD=0ORAD>255T
   HEN150                  :rem 114
170 A$="":POKE214,C+3:PRINT:PO
   KE211,2:INPUT"SUS/REL";A$:
   GOSUB560:IFU=0THEN170
                           :rem 207
180 SR=VAL(A$):IFSR=0ORSR>255T
   HEN170                  :rem 214
190 A$="":POKE214,C+4:PRINT:PO
   KE211,2:INPUT"SUS TIME";A$
   :GOSUB560:IFU=0THEN190
                           :rem 241
200 S1=VAL(A$):IFS1=0ORS1>84TH
   EN190                   :rem 62
210 A$="":POKE214,C+5:PRINT:PO
   KE211,2:INPUT"REL TIME";A$
   :GOSUB560:IFU=0THEN210
                           :rem 204
220 S2=VAL(A$):IFS2=0ORS2>84TH
   EN210                   :rem 60
230 S3=S1+S2:IFS3>84THEN190
                           :rem 78
240 POKE54277,AD:POKE54278,SR:
   POKE54291,AD:POKE54292,SR
                           :rem 34
250 POKE54275,PW:POKE54289,PW:
   POKE54276,W:POKE54290,W:PO
   KEV+21,255              :rem 225
260 FORT=0TOS1:W(T)=PEEK(E):X(
   T)=PEEK(F):NEXT:POKE54276,
   0:POKE54290,0           :rem 212
270 FORT=S1TOS3:W(T)=PEEK(E):X
   (T)=PEEK(F):NEXT        :rem 149
280 FORT=S3TO84:W(T)=0:X(T)=0:
   NEXT                    :rem 103
290 POKE214,3:PRINT:POKE211,19
   :PRINT"WAVE{6 SPACES}ADSR
                           :rem 96
300 POKE214,4:PRINT:POKE211,19
   :PRINT"1 2 3{5 SPACES}1 2
   {SPACE}3                :rem 40
310 POKE214,5:PRINT:POKE211,19
   :PRINT"{5 T}{5 SPACES}
   {5 T}                   :rem 92
320 FORT=0TO20:GOSUB510:NEXT:Q
   =Q+1                    :rem 128
330 FORT=21TO41:GOSUB510:NEXT:
   Q=Q+1                   :rem 183
340 FORT=42TO62:GOSUB510:NEXT:
   Q=Q+1                   :rem 190
350 FORT=63TO83:GOSUB510:NEXT:
   Q=Q+1                   :rem 197
360 FORT=0TO20:GOSUB520:NEXT:Q
   =Q+1                    :rem 133
370 FORT=21TO41:GOSUB520:NEXT:
   Q=Q+1                   :rem 188
380 FORT=42TO62:GOSUB520:NEXT:
   Q=Q+1                   :rem 195
390 FORT=63TO83:GOSUB520:NEXT
                           :rem 85
400 IFQ<>Q1THENPOKE214,18:PRIN
   T:POKE211,22:PRINT"ERASE (
   E)"                     :rem 95
410 IFQ<>Q1THENPOKE214,19:PRIN
   T:POKE211,22:PRINT"QUIT (Q
   )"                      :rem 64
420 IFQ<>Q1THENPOKE214,20:PRIN
   T:POKE211,22:PRINT"COMPARE
    (C)"                   :rem 239
430 IFQ=Q1THENPOKE214,18:PRINT
   :POKE211,22:PRINT"ERASE (E
   )"                      :rem 37
440 IFQ=Q1THENPOKE214,19:PRINT
   :POKE211,22:PRINT"QUIT (Q)
   "                       :rem 6
450 GETA$:IFA$<>"E"THENIFA$<>"
   C"THENIFA$<>"Q"THEN450
                           :rem 45
460 IFA$="E"THENRUN        :rem 120
470 IFA$="C"THENIFQ=Q1THENRUN
                           :rem 69
480 IFA$="C"THENQ=Q-510:C=C+6:
   POKE214,18:PRINT        :rem 223
490 IFA$="C"THENFORT=1TO3:POKE
   211,22:PRINTE$:NEXT:GOTO12
   0                       :rem 63
500 PRINTCHR$(147)CHR$(154):PO
   KEV+21,0:POKE54296,0:POKE5
   3280,14:POKE53281,6:END
                           :rem 79
510 POKEQ,(I↑INT(W(T)/D+A))-OO
   RO:Q=Q+3:RETURN         :rem 78
520 POKEQ,(I↑INT(X(T)/D+A))-OO
   RO:Q=Q+3:RETURN         :rem 80
530 POKE214,C+1:PRINT:POKE211,
   2:INPUT"PULSE WIDTH";A$:GO
   SUB560:IFU=0THEN530
                           :rem 169
540 PW=VAL(A$):IFPW=0ORPW>255T
   HEN530                  :rem 220
550 RETURN                 :rem 122
560 IFA$=""THENRETURN      :rem 31
570 FORN=1TOLEN(A$):U=ASC(MID$
   (A$,N,1)):IFU<47ORU>57THEN
   U=0:RETURN              :rem 102
580 NEXT:RETURN            :rem 246
```

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Power BASIC: List Pager

See special instructions in article on page 72 before typing in.

```
100 PRINT"{CLR}{3 DOWN} *** LI
    ST PAGER ***":FORI=1TO185:
    READA:F$=F$+CHR$(A):NEXT
                           :rem 1
110 PRINT"{2 DOWN}SAVE ON
    {RVS}T{OFF}APE OR {RVS}D
    {OFF}ISK?"             :rem 206
120 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN120                 :rem 20
130 PRINT"{CLR}":IFA$="D"THEN1
    50                     :rem 176
140 OPEN1,1,1,F$:CLOSE1:END
                           :rem 58
150 INPUT"FILENAME";N$:OPEN1,8
    ,4,N$+",P,W":PRINT#1,CHR$(
    65)CHR$(3)F$:CLOSE1
                           :rem 153
160 DATA 169,1,133,251,173,39,
    3,201,3,240,9,141      :rem 250
170 DATA 251,3,173,38,3,141,25
    0,3,169,127,141,38     :rem 53
180 DATA 3,169,3,141,39,3,32,1
    15,0,32,115,0,160      :rem 237
190 DATA 0,132,252,177,122,240
    ,9,201,34,240,6        :rem 148
200 DATA 145,55,200,208,243,24
    ,132,253,152,101       :rem 193
210 DATA 122,133,122,96,132,25
    4,72,165,154,201       :rem 204
220 DATA 4,208,50,165,252,208,
    6,32,192,3,32,242      :rem 251
230 DATA 3,104,72,201,13,208,3
    4,32,242,3,164,252     :rem 32
240 DATA 192,58,208,21,32,242,
    3,200,192,66,208       :rem 210
250 DATA 248,169,0,133,252,165
    ,251,248,24,105,1      :rem 6
260 DATA 216,133,251,104,164,2
    54,96,104,164,254      :rem 11
270 DATA 76,249,3,165,253,240,
    23,160,0,196,253       :rem 220
280 DATA 240,17,177,55,201,35,
    208,5,32,222,3,169     :rem 55
290 DATA 0,32,249,3,200,208,23
    5,76,242,3,165,251     :rem 50
300 DATA 74,74,74,74,9,48,32,2
    49,3,165,251,41,15     :rem 68
310 DATA 9,48,76,249,3,230,252
    ,169,13,76,249,3,76
                           :rem 128
```

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Variable Saver—Home Budget Program

Article on page 76.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
100 REM"↑↑↑↑↑↑↑↑ DUMMY LINE FO
    R SAVED POINTERS.      :rem 63
110 REM **********************
    *************          :rem 52
120 REM **{2 SPACES}HOME
    {2 SPACES}BUDGET{2 SPACES}
    PLANNING{2 SPACES}AID
    {2 SPACES}**           :rem 40
```

```
130 REM ************************
    *************          :rem 54
140 REM ***** IF ↑ STILL THERE
    , NO VARIABLE POOL POINTER
    S SAVED *****          :rem 219
150 IFPEEK(PEEK(43)+PEEK(44)*2
    56+7)=255GOTO230    :rem 81
160 REM ***** RESTORE VARIABLE
     POOL POINTERS *****
                           :rem 55
170 POKE45,PEEK(PEEK(43)+PEEK(
    44)*256+6)             :rem 224
180 POKE46,PEEK(PEEK(43)+PEEK(
    44)*256+7)             :rem 227
190 PS=PEEK(43)+PEEK(44)*256:F
    ORX=0TO5               :rem 229
200 POKE 47+X,PEEK(PS+8+X):NEX
    T                      :rem 83
210 POKE55,PEEK(45):POKE56,PEE
    K(46)+4:GOTO250: REM FASTE
    R SAVE/LOAD            :rem 225
220 REM ***** PERFORM FIRST TI
    ME INITIALIZATION *****
                           :rem 22
230 GOTO580                :rem 107
240 REM ***** CALCULATE AND DI
    SPLAY *****            :rem 149
250 PRINTCS$;:USED=0:FORI=0TOD
    S                      :rem 2
260 PC=(AMT(I)/AMT(0)+.005)*10
    0                      :rem 112
270 I$=RIGHT$(STR$(I)+" ",3)
                           :rem 187
280 A$=RIGHT$("{3 SPACES}"+STR
    $(AMT(I)),5)           :rem 233
290 PC$=RIGHT$(" "+STR$(INT(PC
    )),3)                  :rem 141
300 PRINTI$;LEFT$(ITEM$(I)+FS$
    ,FS);A$;               :rem 221
310 IFI>0THENPRINTPC$"%";:USED
    =USED+AMT(I)           :rem 113
320 PRINT:NEXT             :rem 155
330 PRINT"BUDGETED ="USED;BS$;
    INT((USED/AMT(0))*100);BS$
    "%"                    :rem 176
340 LEFT=AMT(0)-USED:PRINT"REM
    AINING="LEFT;BS$;INT((LEFT
    /AMT(0))*100);BS$"%"
                           :rem 94
350 REM ***** PROMPT FOR USER
    {SPACE}CHANGES *****
                           :rem 33
360 PRINTRV$" CHG "RO$"I"RV$"T
    EM, "RO$"A"RV$"MT, "RO$"N"
    RV$"ONE?"RO$           :rem 240
370 GETB$                  :rem 224
380 IFB$="N" GOTO470       :rem 51
390 IFB$="A" GOTO420       :rem 34
400 IFB$="I" GOTO440       :rem 36
410 GOTO370                :rem 104
420 PRINT"ITEM #"RV$","RO$"ACT
    UAL AMT":INPUTZ,A:IFZ>DSTH
    EN420                  :rem 232
430 AMT(Z)=A:GOTO250       :rem 172
440 PRINT"ITEM #"RV$","RO$"ITE
    M DESC.":INPUTZ,Z$:IFZ>DST
    HEN440                 :rem 9
450 ITEM$(Z)=LEFT$(Z$+FS$,FS):
    GOTO250                :rem 169
460 REM ***** PROMPT FOR SAVE
    {SPACE}VARIABLES *****
                           :rem 179
470 PRINTCU$RV$" SAVE DATA+PGM
     Y/N?{2 SPACES}"       :rem 97
480 GETX$:IFX$="N"THENPRINTCU$
    RV$"SYS"STR$(SR)"
    {2 SPACES}OR GOTO100 TO RU
    N.";:END               :rem 103
490 IFX$<>"Y"THEN480       :rem 138
500 REM ***** SAVE VARIABLE PO
    OL POINTERS *****      :rem 64
510 PRINTCS$"READY FOR SAVE OF
     PROGRAM AND VARIABLES TO
    {SPACE}TAPE OR DISK."
                           :rem 140
520 PRINT"AFTER SAVE, ENTER 'S
    YS"SR"', OR 'GOTO 100'."
                           :rem 252
530 PS=PEEK(43)+PEEK(44)*256:F
    ORX=0TO7               :rem 229
540 POKE PS+6+X,PEEK(45+X):NEX
    T                      :rem 86
550 POKE45,PEEK(55):POKE46,PEE
    K(56)                  :rem 30
560 END                    :rem 114
570 REM ***** FIRST TIME VARIA
    BLE INITIALIZATION *****
                           :rem 73
580 POKE55,PEEK(45):POKE56,PEE
    K(46)+4:CLR: REM FASTER SA
    VE/LOAD                :rem 252
590 REM 256*4=1024 VARIABLE PO
    OL SIZE                :rem 60
600 REM *VIC* SR=64802:DS=17:C
    S$=CHR$(147):FS=9:FS$="...
    ......"                :rem 138
610 SR=64738:DS=19:CS$=CHR$(14
    7):FS=27:FS$="..........
    ..............."       :rem 231
620 PRINTCS$" ?NET MONTHLY INC
    OME?"                  :rem 110
630 DIMAMT(DS),ITEM$(DS)
                           :rem 164
640 INPUT AMT(0)           :rem 141
650 ITEM$(0)="*INCOME* ":AMT(0
    )=INT(AMT(0))          :rem 120
660 ITEM$(1)="HOUSING
    {2 SPACES}":AMT(1)=850
                           :rem 135
670 ITEM$(2)="GROCERIES":AMT(2
    )=100                  :rem 4
680 ITEM$(3)="GAS/ELEC.":AMT(3
    )=53                   :rem 140
690 ITEM$(4)="TELEPHONE":AMT(4
    )=14                   :rem 223
700 ITEM$(5)="LOAN #1
    {2 SPACES}":AMT(5)=155
                           :rem 233
710 ITEM$(6)="LOAN #2
    {2 SPACES}":AMT(6)=145
                           :rem 236
720 ITEM$(7)="GASOLINE ":AMT(7
    )=20                   :rem 138
730 ITEM$(8)="INSURANCE":AMT(8
    )=43                   :rem 232
740 ITEM$(9)="CAR MAINT":AMT(9
    )=12                   :rem 142
750 ITEM$(10)="MC / VISA":AMT(
    10)=70                 :rem 134
760 ITEM$(11)="DONATIONS":AMT(
    11)=10                 :rem 64
770 ITEM$(12)="CLOTHING ":AMT(
    12)=25                 :rem 242
780 ITEM$(13)="EDUCATION":AMT(
    13)=83                 :rem 61
790 ITEM$(14)="HOME REPR":AMT(
    14)=80                 :rem 3
800 ITEM$(15)="RECREAT'N":AMT(
    15)=60                 :rem 20
810 ITEM$(16)="SAVINGS
    {2 SPACES}":AMT(16)=100
                           :rem 226
820 ITEM$(17)="OTHER{4 SPACES}
    ":AMT(17)=45           :rem 36
830 REM *VIC* LEAVE OUT ITEM 1
    8 AND 19               :rem 239
840 ITEM$(18)="OTHER1
    {3 SPACES}":AMT(18)=23
                           :rem 85
850 ITEM$(19)="OTHER2
    {3 SPACES}":AMT(19)=17
                           :rem 92
860 BS$=CHR$(157):CU$=CHR$(145
    ):RV$=CHR$(18):RO$=CHR$(14
    6)                     :rem 201
870 GOTO250                :rem 111
```

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Soft Write Protector

Article on page 97.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: File Protector

```
100 OPEN15,8,15,"I0":OPEN2,8,2
    ,"#":P$="LOCK":REM TO UNLO
    CK FILES, P$="UNLOCK"
                           :rem 64
110 T=18:S=0:NL$=CHR$(0):GOSUB
    230                    :rem 140
120 IFSN=255THENCLOSE2:CLOSE15
    :END                   :rem 154
130 T=TN:S=SN:GOSUB230:rem 129
140 FORJ=0TO7:R(J)=0:NEXT:PRIN
    T"{CLR}TYPE NUMBER OF FILE
    "                      :rem 120
150 PRINT"YOU WISH TO {RVS}";P
    $;"{OFF}"              :rem 20
160 FORJ=0TO7:FT(J)=J*32+2:PRI
    NT#15,"B-P";2;FT(J):GET#2,
    PS$:PS(J)=ASC(PS$+NL$)
                           :rem 60
170 IFPS(J)<>0THENR(J)=1:GOSUB
    250:D=J:GOSUB360:IFFL=1THE
    NJ=7                   :rem 248
180 NEXTJ:GOSUB370         :rem 118
190 GETB$:IFB$=""THEN190
                           :rem 89
200 B=VAL(B$):IFB=TETHEN120
                           :rem 78
210 IFR(B)=0THEN190        :rem 61
220 GOSUB300:GOTO190       :rem 180
230 PRINT#15,"U1";2;0;T;S:GOSU
    B380                   :rem 235
240 GET#2,TN$,SN$:TN=ASC(TN$+N
    L$):SN=ASC(SN$+NL$):RETURN
                           :rem 166
250 GET#2,J$:GET#2,J$:C=0:F$(J
    )=""                   :rem 25
260 GET#2,A$:A=ASC(A$+NL$)
                           :rem 140
270 IFA<>160ANDA<>0THENF$(J)=F
    $(J)+A$:C=C+1:IFC<17THEN26
    0                      :rem 14
280 TE=J+1:IFA=0THENFL=1
                           :rem 188
290 RETURN                 :rem 123
300 PRINT#15,"B-P";2;FT(B)
                           :rem 173
310 IFP$="LOCK"THENPS(B)=PS(B)
    OR64:PRINT#2,CHR$(PS(B));:
```

```
    GOSUB380:GOTO330   :rem 141
320 PS(B)=PS(B)AND191:PRINT#2,
    CHR$(PS(B));:GOSUB380
                       :rem 12
330 PRINT#15,"U2";2;0;T;S:GOSU
    B380               :rem 237
340 PRINT"{HOME}{DOWN}":FORK=0
    TO7:IFR(K)=1THEND=K:GOSUB3
    60                 :rem 178
350 NEXTK:GOSUB370:RETURN
                       :rem 144
360 X=(PS(D)AND64)-4:X=X-(X<0)
    *36:PRINTDCHR$(X);F$(D):RE
    TURN               :rem 90
370 PRINTTE" {RVS}NEXT{OFF}":R
    ETURN              :rem 1
380 INPUT#15,EN,EM$,ET,ES
                       :rem 222
390 IFENTHENPRINTEN,EM$,ET,ES:
    STOP               :rem 248
400 RETURN             :rem 116
```

Program 2: Disk Protector

```
100 PRINT"{CLR}{RVS}DISK PROTE
    CTED"              :rem 220
110 OPEN15,8,15:PRINT#15,"I0":
    OPEN2,8,2,"#"      :rem 76
120 PRINT#15,"U1:";2;0;18;0:GO
    SUB170             :rem 18
130 PRINT#15,"B-P:";2;2:PRINT#
    2,CHR$(80);:GOSUB170
                       :rem 124
140 PRINT#15,"B-P:";2;166:PRIN
    T#2,CHR$(80);:GOSUB170
                       :rem 232
150 PRINT#15,"U2:";2;0;18;0:GO
    SUB170             :rem 22
160 CLOSE2:PRINT#15,"I0":CLOSE
    15:END             :rem 159
170 INPUT#15,EN,EM$,ET,ES
                       :rem 219
180 IFENTHENPRINTEN,EM$,ET,ES:
    STOP               :rem 245
190 RETURN             :rem 122
```

Program 3: Disk Unprotector

```
100 PRINT"{CLR}{RVS}DISK UNPRO
    TECTED"            :rem 127
110 OPEN15,8,15:PRINT#15,"I0":
    OPEN2,8,2,"#"      :rem 76
120 PRINT#15,"U1:";2;0;18;0:GO
    SUB190             :rem 20
130 PRINT#15,"B-P:";2;2:PRINT#
    2,CHR$(65);:GOSUB190
                       :rem 129
140 PRINT#15,"B-P:";2;166:PRIN
    T#2,CHR$(65);:GOSUB190
                       :rem 237
150 PRINT#15,"M-W";CHR$(1);CHR
    $(1);CHR$(1);CHR$(65)
                       :rem 31
160 PRINT#15,"M-W";CHR$(2);CHR
    $(7);CHR$(1);CHR$(65)
                       :rem 39
170 PRINT#15,"U2:";2;0;18;0:GO
    SUB190             :rem 26
180 CLOSE2:PRINT#15,"I0":CLOSE
    15:END             :rem 161
190 INPUT#15,EN,EM$,ET,ES
                       :rem 221
200 IFENTHENPRINTEN,EM$,ET,ES:
    STOP               :rem 238
210 RETURN             :rem 115
```

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Dragon's Den

Article on page 54.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
100 Y=826:POKE53280,0:POKE5328
    1,0:PRINT"{CLR}{5 DOWN}{5
    {7 SPACES}D R A G O N ' S
    {3 SPACES}D E N"   :rem 237
110 PRINT"{10 DOWN}{4 SPACES}P
    LEASE WAIT WHILE MAZE IS D
    RAWN{RED}"         :rem 214
120 BO$="{39 SPACES}":X$="
    {HOME}{23 DOWN}"   :rem 154
130 F=831:G=832:H=829:C=3:DIMM
    $(10,11):FORI=1TO9:FORJ=1T
    010                :rem 179
140 M$(I,J)=STR$(INT((7*RND(1)
    )+1))+STR$(INT((8*RND(1))+
    1)):NEXTJ,I        :rem 243
150 S=I+10:I=INT((8*RND(1))+1)
    :J=INT((9*RND(1))+1):GOTO5
    20                 :rem 233
160 PRINTX$"{RIGHT}{4}";B$:B$=
    "":IFY$="M"THENPRINTTAB(18
    )"{UP}"SL          :rem 47
170 PRINT"{8}{2 UP} {RVS}C
    {OFF}HART {RVS}M{OFF}ARK
    {RVS}B{OFF}ACK";SS$"{RED}"
    :IFHS=1THEN1320    :rem 236
180 IFWT>100ORS<1THEN1180
                       :rem 252
190 GETY$:IFY$=""THEN190
                       :rem 135
200 IFDE=1ANDY$<>"B"THEN190
                       :rem 49
210 GOSUB1580:DE=0:PRINT"{UP}"
    SB$,SB$"{UP}":GOSUB1560:IF
    Y$="C"THEN1420     :rem 166
220 IFY$="M"THENGOSUB1530:GOSU
    B930:SL=SL+1:S=S-1:B$="BRE
    AD SLICES USED":GOTO160
                       :rem 69
230 IFTC=1THENTC=0     :rem 92
240 WT=WT+1:IFY$="L"ANDLD=1ORY
    $="R"ANDRD=1ORY$="A"ANDFD=
    1ORY$="B"THEN280   :rem 134
250 IFY$="T"THENPRINT"{HOME}
    {13 DOWN}"SPC(20)" {UP}"
                       :rem 214
260 IFY$="T"ANDTD=1THEN960
                       :rem 32
270 GOTO160            :rem 105
280 SAF=I:FAS=J:TD=0:LD=0:RD=0
    :FD=0:IFY$="B"THENTC=1
                       :rem 182
290 IFTB=1THEN470      :rem 248
300 IFLT=1THEN370      :rem 249
310 IFRT=1THEN420      :rem 252
320 TB=0:LT=0:RT=0:IFY$="L"THE
    NJ=J-1:LT=1:C=1    :rem 208
330 IFY$="R"THENJ=J+1:RT=1:C=2
                       :rem 11
340 IFY$="A"THENI=I-1:C=3
                       :rem 174
350 IFY$="B"THENI=I+1:TB=1:C=4
                       :rem 237
360 GOTO510            :rem 104
370 TB=0:LT=0:RT=0:IFY$="L"THE
    NI=I+1:TB=1:C=4    :rem 202
380 IFY$="R"THENI=I-1:C=3
                       :rem 195
390 IFY$="A"THENJ=J-1:LT=1:C=1
                       :rem 251
400 IFY$="B"THENJ=J+1:RT=1:C=2
                       :rem 249
410 GOTO510            :rem 100
420 TB=0:LT=0:RT=0:IFY$="L"THE
    NI=I-1:C=3         :rem 137
430 IFY$="R"THENI=I+1:TB=1:C=4
                       :rem 252
440 IFY$="A"THENJ=J+1:RT=1:C=2
                       :rem 252
450 IFY$="B"THENJ=J-1:LT=1:C=1
                       :rem 249
460 GOTO510            :rem 105
470 TB=0:LT=0:RT=0:IFY$="L"THE
    NJ=J+1:RT=1:C=2    :rem 219
480 IFY$="R"THENJ=J-1:LT=1:C=1
                       :rem 12
490 IFY$="A"THENI=I+1:TB=1:C=4
                       :rem 241
500 IFY$="B"THENI=I-1:C=3
                       :rem 173
510 SS$="":GOTO790     :rem 244
520 PRINT"{CLR}":FORIJ=1TO20:P
    RINT"{15 +}"SPC(10)"{14 +}
    ":NEXTIJ           :rem 227
530 PRINT"{HOME}":FORII=1TO4:P
    RINTTAB(15)"{RVS}{R}{E}{R}
    {E}{R}{E}{R}{E}{R}{E}
    {DOWN}{10 LEFT}{E}{R}{E}
    {R}{E}{R}{E}{R}{E}{R}":NEX
    TII                :rem 59
540 PZ=12:ZP=15:FORIJ=1TO12:ZP
    =ZP-1:FORJI=1TOPZ  :rem 42
550 PRINTTAB(ZP)" ";:NEXTJI:PZ
    =PZ+2:PRINT:NEXTIJ:PRINT"
    {HOME}{8 DOWN}"    :rem 37
560 JJ=8:FORII=14TO3STEP-1:JJ=
    JJ+2               :rem 101
570 PRINTTAB(II)"£"SPC(JJ)"
    {*}":NEXTII        :rem 201
580 PRINTLEFT$(X$,19)TAB(16)"
    {4 SPACES}":PRINTTAB(17)"
    {4 SPACES}":PRINTLEFT$(X$,
    19);               :rem 254
590 IFC=3THENPRINTTAB(17)"{8}N
    {RED}":PRINTTAB(17)"↑"
                       :rem 110
600 IFC=4THENPRINTTAB(17)"V":P
    RINTTAB(17)"{8}N{RED}"
                       :rem 95
610 IFC=1THENPRINTTAB(16)"{8}C
    >{RED}N"           :rem 108
620 IFC=2THENPRINTTAB(16)"N{8}
    <C{RED}"           :rem 108
630 IFI>9ORJ>10ORI<1ORJ<1THENS
    AF=I:FAS=J:GOTO760 :rem 91
640 MM=VAL(LEFT$(M$(I,J),2)):O
    NMMGOTO650,660,670,680,690
    ,700,710,760       :rem 223
650 GOSUB850           :rem 184
660 GOSUB770           :rem 186
670 GOSUB880:GOTO720   :rem 201
680 GOSUB850           :rem 187
690 GOSUB770:GOTO720   :rem 201
700 GOSUB880           :rem 183
710 GOSUB850           :rem 181
720 IFRIGHT$(M$(I,J),2)="22"TH
    ENGOSUB930         :rem 42
730 IFMM>4THENGOSUB940:rem 129
740 IFVAL(MID$(M$(I,J),4,1))<6
    THENGOSUB1260      :rem 213
750 GOTO160            :rem 108
760 GOSUB1580:PRINTX$SPC(11);"
    {UP}{RVS}DEAD END{OFF} GO
    {SPACE}{RVS}B{OFF}ACK!":DE
    =1:GOTO180         :rem 9
770 PRINTLEFT$(X$,10):FORGI=1T
    O4:PRINTTAB(18)"{2 UP}
    {4 SPACES}":NEXT   :rem 1
780 PRINTTAB(18)"{2 UP}£
    {2 SPACES}{*}":FD=1:PQ=19:
    SS$=SS$+" {RVS}A{OFF}HEAD"
    :GOTO920           :rem 222
```

```
790 PRINT"{HOME}":FORII=1TO4:P
    RINTTAB(15)"{RVS}{R}{E}{R}
    {E}{R}{E}{R}{E}{R}{E}
    {DOWN}{10 LEFT}{E}{R}{E}
    {R}{E}{R}{E}{R}{E}{R}":NEX
    TII                        :rem 67
800 PRINT"{HOME}{8 DOWN}":FORI
    I=1TO8:PRINTTAB(15)"
    {10 SPACES}":NEXTII
                               :rem 164
810 PRINT"{HOME}{4 DOWN}":FORG
    I=1TO9:PRINTTAB(6)"{4 +}":
    NEXT:LD=0:PRINTTAB(6)"
    {3 +}£"                    :rem 113
820 PRINTTAB(6)"{2 +}£":PRINT
    TAB(6)"{+}£":PRINTTAB(6)"
    £"                         :rem 136
830 PRINT"{HOME}{4 DOWN}":FORG
    I=1TO9:PRINTTAB(30)"{4 +}"
    :NEXT:RD=0:PRINTTAB(30)"
    {*}{3 +}"                  :rem 9
840 PRINTTAB(31)"{*}{2 +}":PRI
    NTTAB(32)"{*}{+}":PRINTTAB
    (33)"{*}":GOTO580          :rem 201
850 PRINTLEFT$(X$,19):FORGI=1T
    O3:PRINTTAB(6)"{2 UP}
    {4 SPACES}":NEXT           :rem 213
860 FORGI=1TO8:PRINTTAB(6)"
    {2 UP}{4 T}":NEXT:LD=1
                               :rem 38
870 SS$=SS$+" {RVS}L{OFF}EFT":
    QP=6:PQ=7:GOTO910          :rem 88
880 PRINTLEFT$(X$,19):FORGI=1T
    O3:PRINTTAB(30)"{2 UP}
    {4 SPACES}":NEXT:RD=1
                               :rem 67
890 FORGI=1TO8:PRINTTAB(30)"
    {2 UP}{4 T}":NEXT:LD=1
                               :rem 86
900 SS$=SS$+" {RVS}R{OFF}IGHT"
    :QP=30:PQ=31               :rem 242
910 PRINTTAB(QP)"{2 UP}£{2 T}
    {*}"                       :rem 36
920 PRINTTAB(PQ)"{2 UP}£{*}":
    RETURN                     :rem 249
930 PRINTLEFT$(X$,16)TAB(20)"
    {8}U*I{DOWN}{3 LEFT}{Z}*
    {X}{RED}":RETURN           :rem 231
940 PRINTLEFT$(X$,13)TAB(17)"N
    {5 T}M":PRINTTAB(16)"N
    {3 SPACES}W{3 SPACES}M"
                               :rem 128
950 PRINTTAB(16)"{9 U}":TD=1:S
    S$=SS$+" {RVS}T{OFF}RAP":R
    ETURN                      :rem 37
960 PRINT"{HOME}{9 DOWN}"TAB(1
    6)"{9 O}":PRINTTAB(16)"M
    {7 SPACES}N"               :rem 165
970 PRINTTAB(17)"M{5 SPACES}N"
                               :rem 156
980 SS=LEN(SS$):SS$=LEFT$(SS$,
    SS-6)                      :rem 94
990 FE=FE+1:                   :rem 139
1000 ONINT((9*RND(1))+1)GOTO11
     50,1010,1010,1150,1030,10
     10,1140,1010,1160,1030
                               :rem 129
1010 B$="{RVS}YOU HEAR SCALES
     {SPACE}RATTLING-RUN!":HS=
     1:PRINTLEFT$(X$,14)TAB(18
     )"* *"                    :rem 27
1020 GOTO160                   :rem 147
1030 IFFE<20THEN1010           :rem 109
1040 Y$="":PRINTX$"{UP}
     {3 SPACES}{8}YOU FOUND AN
      EXIT! {RVS}E{OFF}SCAPE O
     R {RVS}H{OFF}UNT?":FE=5
                               :rem 40
1050 GETY$:IFY$=""THEN1050
                               :rem 223
1060 IFY$="H"THENPRINT"{UP}"SB
     $:GOTO160                 :rem 240
1070 IFY$<>"E"THEN1040:rem 203
1080 PRINT"{CLR}{7 DOWN}{8}
     {5 SPACES}YOU FOUND AN EX
     IT! AND ESCAPED":IFGL=0TH
     EN1200                    :rem 37
1090 PRINT"{DOWN}{10 SPACES}WI
     TH";GL;"GOLD POTS!":GOTO1
     200                       :rem 248
1100 IFSW=0THENGOSUB1400
                               :rem 220
1110 IFSW=0THENPRINT"{CLR}
     {6 DOWN}{8}{5 SPACES}YOU'
     VE BEEN EATEN BY A DRAGON
     ":GOTO1200                :rem 16
1120 B$="{RVS}YOU FOUND A DRAG
     ON AND USED THE SWORD":SW
     =0                        :rem 247
1130 PRINTLEFT$(X$,14)TAB(18)"
     + +":GOTO160              :rem 52
1140 B$="{RVS}FOUND WATER, YOU
     'VE MORE TIME":WT=0:GOTO1
     60                        :rem 103
1150 B$="{RVS}NOTHING THERE":G
     OTO160                    :rem 89
1160 IFSW=1THENB$="{RVS}YOU'VE
      FOUND GOLD!":GL=GL+1:GOT
     O160                      :rem 28
1170 B$="{RVS}YOU'VE FOUND A O
     NE SHOT MAGIC SWORD!":SW=
     1:GOTO160                 :rem 203
1180 IFS<1THENPRINT"{CLR}
     {4 DOWN}{8}{6 SPACES}SORR
     Y - YOU STARVED TO DEATH!
     ":GOTO1200                :rem 205
1190 PRINT"{CLR}{4 DOWN}{8}
     {7 SPACES}SORRY - YOU DIE
     D OF THIRST!":GOTO1200
                               :rem 183
1200 FORIJ=1TO100:NEXT:POKE594
     67,0                      :rem 44
1210 PRINT"{4 DOWN}{12 SPACES}
     TRY AGAIN (Y/N)":AG$=""
                               :rem 198
1220 GETAG$:IFAG$=""THEN1220
                               :rem 59
1230 IFLEFT$(AG$,1)="Y"THENRUN
                               :rem 252
1240 IFLEFT$(AG$,1)<>"N"THEN12
     20                        :rem 255
1250 END                       :rem 159
1260 ONVAL(MID$(M$(I,J),4,1))G
     OSUB1270,1280,1290,1300,1
     310:RETURN                :rem 91
1270 B$="{RVS}THE SMOKE SMELL
     {SPACE}IS STRONG":RETURN
                               :rem 51
1280 B$="{RVS}SOOT IS ON THE W
     ALLS":RETURN              :rem 192
1290 B$="{RVS}YOU CAN HEAR DRI
     PPING WATER!":RETURN
                               :rem 207
1300 B$="{RVS}BLOOD IS ON THE
     {SPACE}FLOOR":RETURN
                               :rem 227
1310 B$="{RVS}YOU HEAR BATS IN
      FLIGHT":RETURN           :rem 116
1320 VB=55:Y$="":HS=0:TD=0
                               :rem 190
1330 GETY$:VB=VB-1:IFVB<45THEN
     1380                      :rem 42
1340 FORIJ=1TO7:NEXT           :rem 3
1350 IFY$="L"ANDLD=1ORY$="R"AN
     DRD=1ORY$="A"ANDFD=1ORY$=
     "B"THEN1370               :rem 193
1360 GOTO1330                  :rem 202
1370 GOTO210                   :rem 151
1380 IFSW>0THEN1120            :rem 102
1390 IFSW<=0THEN1100           :rem 160
1400 PRINTLEFT$(X$,12)TAB(19)"
     X*X":PRINTTAB(18)"(* *)":
     PRINTTAB(18)" JQK"
                               :rem 134
1410 PRINTTAB(17)"<<<><>>>":FO
     RIJ=1TO1500:NEXT:RETURN
                               :rem 45
1420 SS$="":PRINT"{CLR}{PUR}"T
     AB(14)"{10 @}              :rem 99
1430 FORIJ=1TO9:PRINTTAB(13)"
     {OFF}{M}";:FORJI=1TO10
                               :rem 189
1440 MM$=RIGHT$(M$(IJ,JI),2):I
     FIJ=IANDJI=JTHENPRINT"
     {OFF}↑";:GOTO1480         :rem 99
1450 IFMM$="-2"THENPRINT"{OFF}
     L";:GOTO1480              :rem 208
1460 IFMM$="22"THENPRINT"{RVS}
     M";:GOTO1480              :rem 215
1470 PRINT"{RVS} ";            :rem 234
1480 NEXTJI:PRINT"{OFF}{G}":NE
     XTIJ:PRINTTAB(14)"{10 T}
     {RED}"                    :rem 255
1490 PRINT"{3 DOWN}{7 SPACES}
     {WHT}PRESS ANY KEY TO RET
     URN":PRINTTAB(11)"{DOWN}T
     O THE DUNGEON{RED}"
                               :rem 14
1500 GETY$:IFY$=""THEN1500
                               :rem 223
1510 IFRIGHT$(M$(I,J),2)="-2"O
     RRIGHT$(M$(I,J),2)="22"TH
     EN520                     :rem 38
1520 M$(I,J)=M$(I,J)+"-2":GOTO
     520                       :rem 223
1530 IFRIGHT$(M$(I,J),2)="-2"T
     HENM$(I,J)=M$(I,J)+"2":RE
     TURN                      :rem 51
1540 IFRIGHT$(M$(I,J),2)="22"T
     HENRETURN                 :rem 31
1550 M$(I,J)=M$(I,J)+"22":RETU
     RN                        :rem 247
1560 IFRIGHT$(M$(I,J),2)="-2"O
     RRIGHT$(M$(I,J),2)="22"TH
     ENRETURN                  :rem 116
1570 M$(I,J)=M$(I,J)+"-2":RETU
     RN                        :rem 244
1580 PRINTLEFT$(X$,23);BO$:PRI
     NTX$BO$:RETURN            :rem 10
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All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Whirlybird

See instructions in article on page 42 before typing in.

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49152 :027,008,000,000,158,050,243
49158 :048,054,049,000,000,000,157
49164 :169,147,032,210,255,162,219
49170 :000,142,033,208,142,032,063
49176 :208,232,142,027,208,169,242
49182 :003,141,134,002,162,016,232
49188 :169,000,157,000,208,202,004
49194 :016,248,162,024,157,000,137
49200 :212,202,016,250,162,024,146
49206 :189,243,019,157,000,212,106
49212 :202,016,247,169,127,141,194
49218 :013,220,169,051,133,001,141
49224 :169,000,133,251,169,208,234
49230 :133,252,169,000,133,253,250
49236 :169,056,133,254,160,000,088
49242 :177,251,145,253,230,251,117
49248 :208,002,230,252,230,253,247
49254 :208,002,230,254,056,165,249
49260 :252,201,216,144,233,169,043
49266 :055,133,001,169,129,141,230
49272 :013,220,162,008,189,136,080
49278 :019,157,208,058,189,144,133
49284 :019,157,080,059,189,152,020
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49290 :019,157,080,057,202,016,157
49296 :235,169,031,141,024,208,184
49302 :169,201,133,251,169,016,065
49308 :133,252,169,000,133,253,072
49314 :169,060,133,254,160,000,170
49320 :177,251,145,253,230,251,195
49326 :208,002,230,252,230,253,069
49332 :208,002,230,254,056,165,071
49338 :251,233,136,165,252,233,176
49344 :019,144,229,120,169,155,004
49350 :141,020,003,169,015,141,175
49356 :021,003,088,169,240,141,098
49362 :060,003,169,000,141,087,158
49368 :003,141,088,003,032,000,227
49374 :010,169,020,141,011,212,017
49380 :169,021,141,011,212,032,046
49386 :132,014,173,098,003,240,126
49392 :248,206,098,003,169,001,197
49398 :141,081,003,169,000,141,013
49404 :095,003,173,087,003,013,114
49410 :088,003,233,010,144,020,244
49416 :056,173,087,003,233,010,058
49422 :141,087,003,173,088,003,253
49428 :233,000,141,088,003,032,005
49434 :236,013,032,130,016,173,114
49440 :000,220,041,016,208,246,251
49446 :032,188,011,032,171,012,228
49452 :173,070,003,208,008,169,163
49458 :000,141,104,003,076,068,186
49464 :009,173,104,003,208,005,046
49470 :169,001,141,104,003,032,000
49476 :085,014,173,091,003,208,130
49482 :018,032,192,013,032,192,041
49488 :013,032,192,013,032,192,042
49494 :013,032,192,013,076,234,134
49500 :008,173,085,003,240,050,139
49506 :032,253,012,032,177,011,103
49512 :173,000,220,041,015,201,242
49518 :011,240,007,201,007,240,048
49524 :011,076,134,009,169,000,003
49530 :141,083,003,076,134,009,056
49536 :169,001,141,083,003,032,045
49542 :192,013,032,021,010,162,052
49548 :001,142,081,003,138,076,069
49554 :151,009,169,000,141,086,190
49560 :003,032,021,010,032,252,246
49566 :011,173,099,003,240,003,175
49572 :076,237,008,173,000,220,110
49578 :041,015,201,011,240,036,202
49584 :201,007,240,024,173,070,123
49590 :003,208,003,076,045,009,014
49596 :206,100,003,173,100,003,005
49602 :208,045,169,003,141,100,092
49608 :003,076,239,009,173,065,253
49614 :003,208,008,076,234,009,232
49620 :173,065,003,208,016,173,082
49626 :070,003,201,012,144,003,139
49632 :076,045,009,238,070,003,153
49638 :076,045,009,173,070,003,094
49644 :240,006,206,070,003,076,069
49650 :045,009,173,065,003,073,098
49656 :001,141,065,003,076,045,067
49662 :009,169,155,141,007,212,179
49668 :169,003,141,008,212,169,194
49674 :011,141,000,212,169,007,038
49680 :141,001,212,096,238,071,007
49686 :003,173,071,003,208,248,216
49692 :238,072,003,173,072,003,077
49698 :201,015,144,238,169,000,033
49704 :141,072,003,096,169,192,201
49710 :141,073,003,169,007,141,068
49716 :074,003,169,080,133,003,002
49722 :169,004,133,004,169,106,131
49728 :141,075,003,169,013,141,094
49734 :076,003,032,084,011,169,189
49740 :231,141,073,003,169,007,188
49746 :141,074,003,169,119,133,209
49752 :003,169,004,133,004,169,058
49758 :106,141,075,003,032,084,023
49764 :011,169,249,133,003,169,066
49770 :006,133,004,169,030,141,077
49776 :073,003,169,007,141,074,067
49782 :003,169,090,141,075,003,087
49788 :169,007,141,076,003,032,040
49794 :134,011,169,033,133,003,101
49800 :169,007,133,004,169,070,176
49806 :141,073,003,169,007,141,164
49812 :074,003,169,006,141,076,105
49818 :003,032,134,011,169,073,064
49824 :133,003,169,007,133,004,097
49830 :169,110,141,073,003,169,063
49836 :007,141,074,003,169,005,059
49842 :141,076,003,032,134,011,063
49848 :169,113,133,003,169,007,010
49854 :133,004,169,150,141,073,092
49860 :003,169,007,141,074,003,081
49866 :169,007,141,076,003,032,118
49872 :134,011,169,153,133,003,043
49878 :169,007,133,004,169,190,118
49884 :141,073,003,169,007,141,242
49890 :074,003,169,006,141,076,183
49896 :003,032,134,011,169,193,006
49902 :133,003,169,007,133,004,175
49908 :169,230,141,073,003,169,005
49914 :007,141,074,003,169,003,135
49920 :141,076,003,032,134,011,141
49926 :169,087,141,002,007,141,041
49932 :021,007,141,119,007,141,192
49938 :144,007,141,196,007,141,142
49944 :202,007,141,208,007,141,218
49950 :088,007,141,096,007,141,254
49956 :215,007,141,221,007,141,000
49962 :227,007,169,001,141,002,077
49968 :219,141,021,219,141,119,140
49974 :219,141,144,219,141,196,090
49980 :219,141,202,219,141,208,166
49986 :219,141,215,219,141,088,065
49992 :219,141,096,219,141,221,085
49998 :219,141,227,219,096,160,116
50004 :000,173,075,003,145,003,227
50010 :165,003,133,005,024,165,073
50016 :004,105,212,133,006,173,217
50022 :076,003,145,005,024,165,008
50028 :003,105,040,133,003,165,045
50034 :004,105,000,133,004,056,160
50040 :173,073,003,229,003,173,006
50046 :074,003,229,004,176,209,053
50052 :096,160,000,173,075,003,127
50058 :145,003,165,003,133,005,080
50064 :024,165,004,105,212,133,019
50070 :006,173,076,003,145,005,046
50076 :230,003,208,002,230,004,065
50082 :056,173,073,003,229,003,187
50088 :173,074,003,229,004,176,059
50094 :216,096,169,032,160,000,079
50100 :145,251,169,001,145,253,120
50106 :096,032,248,011,201,035,041
50112 :176,249,141,079,003,024,096
50118 :169,202,109,079,003,133,125
50124 :251,169,004,105,000,133,098
50130 :252,024,165,251,105,000,239
50136 :133,253,165,252,105,212,056
50142 :133,254,169,001,141,081,233
50148 :003,032,248,011,048,007,065
50154 :169,000,141,083,003,240,102
50160 :005,169,001,141,083,003,130
50166 :096,173,027,212,096,169,251
50172 :000,141,099,003,032,177,192
50178 :011,173,083,003,208,022,246
50184 :032,053,012,160,000,177,186
50190 :251,201,106,240,002,208,254
50196 :059,032,067,012,032,228,194
50202 :012,076,252,011,032,067,220
50208 :012,160,000,177,251,201,065
50214 :106,240,002,208,037,032,151
50220 :053,012,032,228,012,076,201
50226 :252,011,056,165,251,233,250
50232 :001,133,251,165,252,233,067
50238 :000,133,252,096,024,165,220
50244 :251,105,001,133,251,165,206
50250 :252,105,000,133,252,096,144
50256 :165,251,133,170,165,252,192
50262 :133,171,173,081,003,208,087
50268 :027,056,165,251,233,081,137
50274 :165,252,233,004,144,090,218
50280 :056,165,251,233,040,133,214
50286 :251,165,252,233,000,133,120
50292 :252,076,145,012,056,165,054
50298 :251,233,192,165,252,233,168
50304 :007,176,077,024,165,251,060
50310 :105,040,133,251,165,252,056
50316 :105,000,133,252,177,251,034
50322 :201,087,208,003,076,024,233
50328 :013,201,090,240,007,201,136
50334 :106,240,066,076,171,012,061
50340 :032,217,012,032,065,014,024
50346 :160,000,169,042,145,251,169
50352 :024,165,251,105,000,133,086
50358 :253,165,252,105,212,133,022
50364 :254,169,001,145,253,096,082
50370 :169,001,141,081,003,141,218
50376 :099,003,169,000,141,070,170
50382 :003,096,169,000,141,081,184
50388 :003,076,253,012,173,081,042
50394 :003,073,001,141,081,003,008
50400 :076,253,012,173,083,003,056
50406 :073,001,141,083,003,076,095
50412 :253,012,056,165,251,233,182
50418 :040,133,251,165,252,233,036
50424 :000,133,252,096,169,064,194
50430 :141,004,212,032,130,016,021
50436 :169,180,141,094,003,169,248
50442 :001,141,093,003,141,095,228
50448 :003,169,065,141,004,212,098
50454 :096,032,000,010,169,003,076
50460 :141,070,003,169,002,141,042
50466 :032,208,141,033,208,032,176
50472 :177,011,032,130,016,238,132
50478 :001,208,238,001,208,173,107
50484 :001,208,141,001,212,201,048
50490 :233,144,002,176,005,173,023
50496 :085,003,240,230,032,253,139
50502 :012,032,248,011,201,032,094
50508 :176,249,141,079,003,169,125
50514 :172,133,176,169,006,133,103
50520 :177,160,000,024,165,176,022
50526 :109,079,003,133,176,165,247
50532 :177,105,000,133,177,177,101
50538 :176,201,106,240,216,200,221
50544 :192,005,208,245,160,002,156
50550 :169,106,145,176,024,165,135
50556 :176,105,000,133,176,165,111
50562 :177,105,212,133,177,169,079
50568 :003,145,176,160,000,173,025
50574 :001,208,201,060,144,018,006
50580 :032,130,016,206,001,208,229
50586 :206,001,208,173,001,208,183
50592 :141,001,212,076,142,013,233
50598 :173,031,208,169,000,141,120
50604 :032,208,141,033,208,141,167
50610 :085,003,032,253,012,104,155
50616 :104,032,000,010,076,029,179
50622 :009,024,173,087,003,105,079
50628 :010,141,087,003,173,088,186
50634 :003,105,000,141,088,003,030
50640 :056,173,087,003,237,012,008
50646 :020,173,088,003,237,013,236
50652 :020,144,012,173,087,003,147
50658 :141,012,020,173,088,003,151
50664 :141,013,020,169,019,032,114
50670 :210,255,162,011,169,032,053
50676 :157,000,004,202,016,250,105
50682 :169,029,032,210,255,169,090
50688 :029,032,210,255,174,087,019
50694 :003,173,088,003,032,205,254
50700 :189,169,032,032,210,255,131
50706 :169,160,160,019,032,030,076
50712 :171,174,012,020,173,013,075
50718 :020,032,205,189,169,032,165
50724 :032,210,255,169,208,160,046
50730 :019,032,030,171,174,098,054
50736 :003,169,000,032,205,189,134
50742 :169,032,032,210,255,169,153
50748 :032,076,210,255,024,173,062
50754 :087,003,105,001,141,087,234
50760 :003,173,088,003,105,000,188
50766 :141,088,003,076,209,013,096
50772 :169,000,141,091,003,133,109
50778 :170,169,004,133,171,160,129
50784 :000,177,170,201,090,240,206
50790 :022,201,087,240,018,230,132
50796 :170,208,002,230,171,056,177
50802 :165,170,233,230,165,171,224
50808 :233,007,144,229,096,169,230
50814 :001,141,091,003,096,032,234
50820 :000,010,173,014,020,141,234
50826 :098,003,169,003,141,100,140
50832 :003,169,147,032,210,255,192
50838 :169,000,141,021,208,032,209
50844 :045,010,032,236,013,169,149
50850 :001,141,029,208,169,061,003
50856 :141,001,208,169,243,141,047
50862 :248,007,141,060,003,169,034
50868 :006,141,062,003,169,002,051
50874 :141,070,003,169,001,141,199
50880 :081,003,141,083,003,169,160
50886 :080,141,063,003,141,000,114
50892 :208,169,000,141,064,003,021
50898 :141,016,208,141,065,003,016
50904 :162,008,189,181,019,157,164
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50910 :077,005,169,003,157,077,198
50916 :217,189,190,019,157,117,093
50922 :005,169,003,157,117,217,134
50928 :189,199,019,157,157,005,198
50934 :169,003,157,157,217,202,127
50940 :016,220,169,034,141,068,132
50946 :003,169,000,141,069,003,131
50952 :169,032,141,066,003,169,076
50958 :001,141,067,003,169,001,140
50964 :141,021,208,032,130,016,056
50970 :173,000,220,041,015,201,164
50976 :014,240,007,201,013,240,235
50982 :012,076,061,015,238,098,026
50988 :003,032,040,014,076,055,008
50994 :015,206,098,003,032,040,188
51000 :014,032,021,010,165,197,239
51006 :201,004,240,011,201,005,212
51012 :240,020,201,003,240,073,077
51018 :076,024,015,169,000,141,243
51024 :092,003,169,001,141,029,003
51030 :208,076,121,015,169,001,164
51036 :141,092,003,169,000,141,126
51042 :029,208,169,032,141,068,233
51048 :003,169,000,141,069,003,233
51054 :169,055,141,066,003,169,201
51060 :001,141,067,003,162,008,242
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51072 :117,005,157,157,005,202,003
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51216 :169,240,141,060,003,208,069
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51954 :000,024,000,000,024,000,034
51960 :000,126,000,000,000,000,118
51966 :000,000,000,000,000,000,254
51972 :000,000,000,000,000,000,004
51978 :000,000,000,000,000,000,010
51984 :000,000,000,000,000,000,016
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52056 :000,000,000,024,000,008,120
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52074 :255,002,128,060,001,000,040
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52140 :029,072,073,071,072,058,035
52146 :032,000,006,049,032,014,055
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52194 :029,029,029,029,029,029,144
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52230 :000,000,100,243,063,000,156
52236 :000,010,013,013,013,013,074
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All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Quickchange

See instructions in article on page 46 before typing in.

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49212 :002,133,144,206,045,085,163
49218 :173,045,085,041,015,009,178
49224 :120,141,022,212,032,127,214
49230 :193,032,209,195,032,226,197
49236 :197,032,189,195,032,183,144
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49248 :032,171,192,032,217,192,164
49254 :076,044,192,173,167,002,244
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49266 :171,192,198,248,240,020,159
49272 :165,144,240,179,165,193,182
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49290 :044,192,032,183,198,162,181
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49452 :005,009,007,007,007,007,086
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50676 :195,024,105,000,133,170,103
50682 :189,158,195,105,212,133,218
50688 :171,160,002,177,170,041,209
50694 :015,201,011,208,041,198,168
50700 :171,160,254,177,170,041,217
50706 :015,201,011,208,029,230,200
50712 :171,160,000,169,011,145,168
50718 :170,157,182,003,230,006,010
50724 :032,050,193,169,100,024,092
50730 :101,193,133,193,165,194,253
50736 :105,000,133,194,198,002,168
50742 :198,002,016,177,165,251,095
50748 :024,105,000,133,170,165,145
50754 :252,105,212,133,171,160,075
50760 :002,177,170,041,015,201,166
50766 :011,208,040,160,080,177,242
50772 :170,041,015,201,011,208,218
50778 :030,198,171,160,254,177,056
50784 :170,041,015,201,011,208,230
50790 :018,160,176,177,170,041,076
50796 :015,201,011,208,008,238,021
50802 :167,002,169,001,133,248,066
50808 :096,096,162,001,160,014,137
50814 :024,032,240,255,169,254,076
50820 :160,199,032,030,171,162,118
50826 :003,160,000,024,032,240,085
50832 :255,169,170,160,199,032,105
50838 :030,171,162,008,160,038,207
50844 :024,032,240,255,169,219,071
50850 :160,199,032,030,171,162,148
50856 :023,160,005,024,032,240,140
50862 :255,169,139,160,199,032,104
50868 :030,171,096,032,040,199,236
50874 :165,193,133,187,165,194,199
50880 :133,188,169,046,133,002,095
50886 :169,006,133,003,169,000,166
50892 :162,002,149,189,202,016,156
50898 :251,133,192,162,015,006,201
50904 :187,038,188,120,248,165,138
50910 :189,101,189,133,189,165,164
50916 :190,101,190,133,190,165,173
50922 :191,101,191,133,191,216,233
50928 :088,202,016,227,160,000,165
50934 :162,002,181,189,072,074,158
50940 :074,074,074,032,021,199,214
50946 :104,041,015,032,021,199,158
50952 :202,016,237,152,024,105,232
50958 :040,168,169,032,145,002,058
50964 :096,197,192,208,001,096,042
50970 :009,048,133,192,072,152,120
50976 :024,105,040,168,104,145,106
50982 :002,096,165,193,056,229,011
50988 :141,165,194,229,142,144,035
50994 :008,165,193,133,141,165,087
```

```
51000 :194,133,142,165,247,009,178
51006 :048,141,163,007,165,141,215
51012 :133,187,165,142,133,188,248
51018 :169,008,133,002,169,006,049
51024 :133,003,032,202,198,165,045
51030 :248,009,048,141,185,007,212
51036 :198,195,208,016,169,011,121
51042 :133,195,198,196,016,008,076
51048 :032,082,193,104,104,076,183
51054 :158,192,162,047,165,196,006
51060 :056,232,233,010,016,251,146
51066 :142,174,007,024,105,010,072
51072 :009,048,141,175,007,173,169
51078 :141,002,208,251,096,158,222
51084 :076,069,086,069,076,032,036
51090 :032,032,032,032,032,032,082
51096 :084,073,077,069,032,032,007
51102 :032,032,032,032,032,032,094
51108 :077,069,078,032,032,000,196
51114 :072,017,157,073,017,157,151
51120 :071,017,157,072,017,157,155
51126 :032,017,157,083,017,157,133
51132 :067,017,157,079,017,157,170
51138 :082,017,157,069,017,157,181
51144 :032,017,157,032,017,157,100
51150 :032,017,157,032,017,157,106
51156 :032,017,157,032,017,157,112
51162 :000,083,017,157,067,017,047
51168 :157,079,017,157,082,017,221
51174 :157,069,017,157,032,017,167
51180 :157,032,017,157,032,017,136
51186 :157,032,017,157,032,017,142
51192 :157,032,017,157,032,000,131
51198 :158,146,081,085,073,067,096
51204 :075,067,072,065,078,071,176
51210 :069,000,018,005,071,065,238
51216 :077,069,032,079,086,069,172
51222 :082,146,000,013,013,013,033
```

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

Banners

Article on page 58.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: Banners—64 Version

```
100 POKE56,48:POKE55,0:CLR:CU=
    53272:GOSUB520:SYS828:POKE
    53281,15:MT$=""
110 PRINT"{CLR}{BLK}{RVS}
    {13 SPACES}BANNER PRINTER
    {13 SPACES}{OFF}"
120 CC=0:PRINT"{3 DOWN}PRESS A
     KEY:":PRINT"{2 DOWN}{RVS}
    U{OFF}←FOR UPPER CASE AND
    {SPACE}GRAPHICS"
130 PRINT"{2 DOWN}{RVS}L{OFF}←
    FOR UPPER/LOWER CASE"
140 PRINT"{2 DOWN}{RVS}C{OFF}←
    FOR CUSTOM CHARACTER SET (
    CHARACTER{3 SPACES}DATA MU
    ST BE AT 12288!)"
150 GETCH$:IFCH$=""THEN150
160 IFCH$="U"THENCH=16384:PRIN
    TCHR$(142):GOTO200
170 IFCH$="L"THENCH=16384+2048
    :PRINTCHR$(14):GOTO200
180 IFCH$="C"THENFORK=12544TO1
    2551:POKEK,0:NEXT:CH=12288
    :GOSUB510:GOTO200
190 GOTO150
200 PRINT"{CLR}{RVS}WHAT CHARA
    CTER DO YOU WANT TO MAKE U
    P{3 SPACES}THE LARGE LETTE
    RS"
210 GOSUB610:PP$=MT$
220 MT$="":PRINT"{CLR}{RVS}WHA
    T IS YOUR MESSAGE
    {2 SPACES}":GOSUB610:N$=MT
    $
230 PRINT"{RVS}HOW TALL (1 TO
    {SPACE}9)";:INPUTTS:IFTS<1
    THENTS=1
240 PRINT"{RVS}HOW WIDE (1 TO"
    TS"{LEFT})";:INPUTWS:IFWS>
    TSORWS<1THENWS=TS
250 OPEN1,4
260 FORL=1TOLEN(N$)
270 A$=MID$(N$,L,1):PRINT"
    {RVS}{HOME}{9 DOWN}PRINTIN
    G{OFF} "A$:IFA$=" "THENGOS
    UB480:GOTO380
280 Q=ASC(A$):Q=Q+(Q>63)*64+(Q
    >191)*64+(Q=255)*33
290 I=CH+Q*8
300 FORJ=7TO0STEP-1
310 FORK=7TO0STEP-1
320 B=PEEK(I+K)
330 IFBAND2↑JTHENFORT=1TOTS:PR
    $=PR$+PP$:NEXTT:GOTO350
340 FORT=1TOTS:PR$=PR$+" ":NEX
    TT
350 NEXTK
360 FORX=1TOWS:PRINT#1,CHR$(15
    )SPC((72-TS*8)/2)PR$CHR$(8
    ):NEXTX:PR$=""
370 NEXTJ
380 NEXTL
390 PRINT#1,CHR$(8):CLOSE1
400 IF(PEEK(CU)AND12)=12THENPO
    KECU,(PEEK(CU)AND240)OR4:C
    C=1
410 PRINT"{CLR}PRESS A KEY:":P
    RINT"{DOWN}X TO EXIT PROGR
    AM":PRINT"{DOWN}R TO REPRI
    NT MESSAGE"
420 PRINT"{DOWN}N TO ENTER NEW
     MESSAGE"
430 GETY$:IFY$=""THEN430
440 IFY$="R"THENGOSUB490:PRINT
    "{CLR}"N$:GOTO250
450 IFY$="X"THENOPEN1,4:PRINT#
    1,CHR$(15):CLOSE1:PRINT"
    {CLR}":END
460 IFY$="N"THEN110
470 GOTO430
480 FORX=1TO8*WS:PRINT#1,CHR$(
    8):NEXT:RETURN
490 IFCC=1THENCC=0:GOSUB510
500 RETURN
510 POKECU,(PEEK(CU)AND240)OR1
    2:RETURN
520 FORI=828TO887:READA:X=X+A:
    POKEI,A:NEXTI
530 IFX<>8638THENPRINT"ERROR I
    N DATA STATEMENTS.":STOP
540 RETURN
550 DATA 173,14,220,41,254,141
    ,14,220,169,208
560 DATA 133,252,169,64,133,25
    4,165,1,41,251
570 DATA 133,1,169,0,133,251,1
    33,253,168,162
580 DATA 16,177,251,145,253,20
    0,208,249,230
590 DATA 252,230,254,202,208,2
    42,165,1,9,4
600 DATA 133,1,173,14,220,9,1,
    141,14,220,96
610 POKE198,5:POKE631,155:POKE
    632,34:POKE633,34:POKE634,
    20:POKE635,144
620 INPUTMT$:RETURN
```

Program 2: Banners—VIC Version

```
100 POKE56,28:POKE55,0:CLR
                          :rem 11
110 CC=0:PRINT"{CLR}{BLK}{RVS}
    {4 SPACES}BANNER PRINTER
    {4 SPACES}{OFF}":PRINT"
    {2 DOWN}PRESS A KEY:"
                          :rem 79
120 PRINT"{2 DOWN}{RVS}U{OFF}←
    FOR UPPER CASE AND
    {4 SPACES}GRAPHICS":PRINT"
    {2 DOWN}{RVS}L{OFF}←FOR UP
    PER/LOWER CASE"       :rem 84
130 PRINT"{2 DOWN}{RVS}C{OFF}←
    FOR CUSTOM CHARACTER
    {2 SPACES}SET (CHARACTER D
    ATA{3 SPACES}MUST BE IN PL
    ACE1)"                :rem 237
140 GETCH$:IFCH$=""THEN140
                          :rem 225
150 IFCH$="U"THENCH=32768:PRIN
    TCHR$(142):GOTO190:rem 104
160 IFCH$="L"THENCH=32768+2048
    :PRINTCHR$(14):GOTO190
                          :rem 39
170 IFCH$="C"THENFORK=7424TO74
    31:POKEK,0:NEXT:POKE36869,
    255:CH=7168:GOTO190:rem 42
180 GOTO140               :rem 103
190 PRINT"{CLR}{RVS}WHAT CHARA
    CTER DO YOU WANT TO MAKE U
    P THE{3 SPACES}LARGE LETTE
    RS":GOSUB490          :rem 199
200 PP$=MT$:PRINT"{CLR}{RVS}WH
    AT IS YOUR MESSAGE
    {2 SPACES}":GOSUB490:N$=MT
    $                     :rem 49
210 PRINT"{RVS}HOW TALL (1 TO
    {SPACE}9)";:INPUTTS:IFTS<1
    THENTS=1              :rem 188
220 PRINT"{RVS}HOW WIDE (1 TO"
    TS"{LEFT})";:INPUTWS:IFWS>
    TSORWS<1THENWS=1      :rem 65
230 OPEN1,4               :rem 88
240 FORL=1TOLEN(N$)       :rem 124
250 A$=MID$(N$,L,1):PRINT"
    {RVS}{HOME}{10 DOWN}PRINTI
    NG{OFF} "A$:IFA$=" "THENGO
    SUB460:GOTO360        :rem 15
260 Q=ASC(A$):Q=Q+(Q>63)*64+(Q
    >191)*64+(Q=255)*33:rem 68
270 I=CH+Q*8              :rem 136
280 FORJ=7TO0STEP-1       :rem 172
290 FORK=7TO0STEP-1       :rem 174
300 B=PEEK(I+K)           :rem 71
310 IFBAND2↑JTHENFORT=1TOTS:PR
    $=PR$+PP$:NEXTT:GOTO330
                          :rem 252
320 FORT=1TOTS:PR$=PR$+" ":NEX
    TT                    :rem 199
330 NEXTK                 :rem 32
340 FORX=1TOWS:PRINT#1,CHR$(15
    )SPC((72-TS*8)/2)PR$CHR$(8
    ):NEXTX:PR$=""        :rem 186
350 NEXTJ                 :rem 33
360 NEXTL                 :rem 36
370 PRINT#1,CHR$(8):CLOSE1
                          :rem 18
380 POKE36879,26:IFPEEK(36869)
    =255THENCC=1:POKE36869,240
                          :rem 245
390 PRINT"{CLR}PRESS A KEY:":P
    RINT"{2 DOWN}X TO EXIT PRO
    GRAM":PRINT"{2 DOWN}R TO R
    EPRINT MESSAGE"       :rem 182
```

```
400 PRINT"{2 DOWN}N TO ENTER N
    EW MESSAGE"          :rem 229
410 GETY$:IFY$=""THEN410
                         :rem 125
420 IFY$="X"THENOPEN1,4:PRINT#
    1,CHR$(15):CLOSE1:POKE3687
    9,27:PRINT"{CLR}":END
                         :rem 11
430 IFY$="R"THENGOSUB470:PRINT
    "{CLR}"N$:GOTO230    :rem 216
440 IFY$="N"THEN110      :rem 52
450 GOTO410              :rem 103
460 FORX=1TO8*WS:PRINT#1,CHR$(
    8):NEXT:RETURN       :rem 90
470 IFCC=1THENPOKE36869,255:CC
    =0                   :rem 129
480 RETURN               :rem 124
490 POKE198,5:POKE631,5:POKE63
    2,34:POKE633,34:POKE634,20
    :POKE635,144         :rem 194
500 MT$="":INPUTMT$:RETURN
                         :rem 132
```

Program 3: Banners: Plus/4 and 16 Version

```
100 POKE56,52:POKE55,0:CLR:CU=
    65298:GOSUB520:SYS819:COLO
    R0,2,5
110 PRINT"{CLR}{BLK}{RVS}
    {13 SPACES}BANNER PRINTER
    {13 SPACES}{OFF}"
120 CC=0:PRINT"{3 DOWN}PRESS A
     KEY:":PRINT"{2 DOWN}{RVS}
    U{OFF}←FOR UPPER CASE AND
    {SPACE}GRAPHICS"
130 PRINT"{2 DOWN}{RVS}L{OFF}←
    FOR UPPER/LOWER CASE"
140 PRINT"{2 DOWN}{RVS}C{OFF}←
    FOR CUSTOM CHARACTER SET (
    CHARACTER{3 SPACES}DATA MU
    ST BE AT 13312!)"
150 GETCH$:IFCH$=""THEN150
160 IFCH$="U"THENCH=14336:PRIN
    TCHR$(142):GOTO200
170 IFCH$="L"THENCH=14336+1024
    :PRINTCHR$(14):GOTO200
180 IFCH$="C"THENFORK=13568TO1
    3575:POKEK,0:NEXT:CH=13312
    :GOSUB510:GOTO200
190 GOTO150
200 PRINT"{CLR}{RVS}WHAT CHARA
    CTER DO YOU WANT TO MAKE U
    P{3 SPACES}THE LARGE LETTE
    RS"
210 GOSUB590:PP$=MT$
220 PRINT"{CLR}{RVS}WHAT IS YO
    UR MESSAGE{2 SPACES}":GOSU
    B590:N$=MT$
230 PRINT"{RVS}HOW TALL (1 TO
    {SPACE}9)";:INPUTTS:IFTS<1
    THENTS=1
240 PRINT"{RVS}HOW WIDE (1 TO"
    TS"{LEFT})";:INPUTWS:IFWS>
    TSORWS<1THENWS=TS
250 OPEN1,4
260 FORL=1TOLEN(N$)
270 A$=MID$(N$,L,1):PRINT"
    {RVS}{HOME}{9 DOWN}PRINTIN
    G{OFF} "A$:IFA$=" "THENGOS
    UB480:GOTO380
280 Q=ASC(A$):Q=Q+(Q>63)*64+(Q
    >191)*64+(Q=255)*33
290 I=CH+Q*8
300 FORJ=7TO0STEP-1
310 FORK=7TO0STEP-1
320 B=PEEK(I+K)
330 IFBAND2↑JTHENFORT=1TOTS:PR
    $=PR$+PP$:NEXTT:GOTO350
340 FORT=1TOTS:PR$=PR$+" ":NEX
    TT
350 NEXTK
360 FORX=1TOWS:PRINT#1,CHR$(15
    )SPC((72-TS*8)/2)PR$CHR$(8
    ):NEXTX:PR$=""
370 NEXTJ
380 NEXTL
390 PRINT#1,CHR$(8):CLOSE1
400 IFCH$="C"THENPOKECU,196:PO
    KECU+1,208:CC=1
410 PRINT"{CLR}PRESS A KEY:":P
    RINT"{DOWN}X TO EXIT PROGR
    AM":PRINT"{DOWN}R TO REPRI
    NT MESSAGE"
420 PRINT"{DOWN}N TO ENTER NEW
     MESSAGE"
430 GETY$:IFY$=""THEN430
440 IFY$="R"THENGOSUB490:PRINT
    "{CLR}"N$:GOTO250
450 IFY$="X"THENOPEN1,4:PRINT#
    1,CHR$(15):CLOSE1:PRINT"
    {CLR}":END
460 IFY$="N"THEN110
470 GOTO430
480 FORX=1TO8*WS:PRINT#1,CHR$(
    8):NEXT:RETURN
490 IFCC=1THENCC=0:GOSUB510
500 RETURN
510 POKECU,PEEK(CU)AND251:POKE
    CU+1,PEEK(CU+1)AND3OR52:RE
    TURN
520 FORI=819TO850:READA:POKEI,
    A:X=X+A:NEXT
530 IFX<>5848THENPRINT"ERROR I
    N DATA STATEMENTS.":STOP
540 RETURN
550 DATA 169,56,133,254,169,20
    8,133,252,169,0
560 DATA 133,251,133,253,168,1
    62,8,177,251
570 DATA 145,253,200,208,249,2
    30,252,230,254
580 DATA 202,208,242,96
590 POKE239,5:POKE1319,155:POK
    E1320,34:POKE1321,34:POKE1
    322,20:POKE1323,144
600 INPUTMT$:RETURN
```

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

The Construction Set

See instructions in article on page 60 before typing in.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: Main Program

```
100 POKE53280,1:POKE53281,1
                         :rem 232
110 PRINT"{CLR}{10 DOWN}
    {9 SPACES}{20 @}"    :rem 112
120 PRINT"{9 SPACES}{RVS}THE C
    ONSTRUCTION SET":A$="
    {2 SPACES}{RED}{8 @}"
                         :rem 74
130 PRINT"{7 DOWN}{12 SPACES}P
    LEASE WAIT...        :rem 51
140 POKE55,0:POKE56,64:CLR:BA=
    16384:READA:FORI=1TOA:READ
    X$:NEXT:FORI=1TO352
                         :rem 194
150 READX:S=S+X:NEXT:IFS<>3454
    6THENPRINT"ERROR IN DATA S
    TATEMENTS.":STOP     :rem 176
160 RESTORE:DI=8:READNS:REM SE
    T DI=1 FOR TAPE      :rem 4
170 DATA 3,"HOUSE","CREATURE",
    "SHAPES"             :rem 216
180 PRINT"{UP}{14 SPACES}LOADI
    NG...{2 SPACES}":FORN=0TON
    S-1:CHSET=BA+6144+N*2048:R
    EADX$                :rem 175
190 GOSUB1200:NEXT:PRINT"{CLR}
    {RVS}{GRN}":FORN=1TO40:PRI
    NT"{Y}";:NEXT        :rem 126
200 PRINTA$:PRINT"{2 SPACES}
    {RVS}{RED}{3 SPACES}F1
    {3 SPACES}{OFF}{BLU}
    {9 SPACES}FOR DIFFERENT PI
    CTURE";              :rem 186
210 PRINTA$:PRINT"{2 SPACES}
    {RVS}{RED}{3 SPACES}F7
    {3 SPACES}{OFF}{BLU}
    {9 SPACES}FOR INSTRUCTIONS
    "                    :rem 136
220 PRINTA$:PRINT"{2 SPACES}
    {RVS}{RED}+ AND - {OFF}
    {BLU}{9 SPACES}FOR EXTRA P
    IECES"               :rem 191
230 PRINTA$:PRINT"{2 SPACES}
    {RVS}{RED} CURSOR {BLU}
    {OFF}{9 SPACES}SELECTS PIE
    CE"                  :rem 200
240 PRINT"{2 SPACES}{RED}
    {10 @}":PRINT"{2 SPACES}
    {RVS}{RED} JOYSTICK {BLU}
    {OFF}{7 SPACES}POSITIONS P
    IECE"                :rem 115
250 PRINT"{2 SPACES}{RED}
    {13 @}":PRINT"{2 SPACES}
    {RVS}{RED} FIRE BUTTON
    {OFF}{BLU}{4 SPACES}STAMPS
     PIECE"              :rem 2
260 PRINT"{2 SPACES}{RED}
    {10 @}":PRINT"{2 SPACES}
    {RVS}{RED} INST DEL {OFF}
    {BLU}{7 SPACES}ERASES PIEC
    E"                   :rem 19
270 PRINT"{2 SPACES}{RED}
    {16 @}":PRINT"{2 SPACES}
    {RVS}{RED} SHIFT CLR HOME
    {SPACE}{OFF}{BLU} ERASES S
    CREEN"               :rem 187
280 PRINT"{2 SPACES}{RED}
    {38 @}";             :rem 26
290 PRINT"{2 SPACES}{RVS}{RED}
    PUSH ← AND THEN F1, F3, F5
    {12 SPACES}"         :rem 254
300 PRINT"{2 SPACES}{BLU}TO CH
    ANGE BORDER, SCREEN, & PIC
    TURE{5 SPACES}COLOR. F7 RE
    SUMES PROGRAM"       :rem 74
310 PRINT"{RVS}{GRN}":FORN=1TO
    40:PRINT"{Y}";:NEXT
                         :rem 239
320 PRINT"{13}{9 SPACES}USE POR
    T 2 FOR JOYSTICK.";:rem 11
330 V=53248:SB=15360+BA:SC=BA:
    H1=33:CB=1:MM=254:MN=-1
                         :rem 23
340 SE=8:FORSP=0TO2:FORN=0TO63
    :READD:POKESB+N+(64*SP),D:
    NEXT:NEXT            :rem 184
350 FORA=53088TO53247:READI:PO
    KEA,I:NEXT:SYS53088:POKE17
    400,241:POKE17401,240
                         :rem 117
```

```
360 POKE17402,242:POKEV+39,1:P
    OKEV+3,205:POKEV+2,24:POKE
    V+40,10:POKEV+28,1 :rem 87
370 POKEV+37,5:POKEV+38,1:POKE
    V+28,PEEK(V+28)OR4:POKEV+4
    1,1                :rem 41
380 DIMA$(80,3):X=1:FORC=1TO20
                       :rem 201
390 CO=CO+1:FORR=1TO3:A$(C,R)=
    STR$(X):X=X+32:NEXT:X=X-93
    :IFCO=10THENCO=0:X=X+66
                       :rem 153
400 NEXTC:CO=0:FORC=21TO50:CO=
    CO+1:A$(C,1)=STR$(X):A$(C,
    2)="256":A$(C,3)="256"
                       :rem 68
410 X=X+3:IFCO=10THENCO=0:X=X+
    2                  :rem 139
420 NEXT:POKE53265,PEEK(53265)
    AND239:POKE56578,PEEK(5657
    8)OR3              :rem 88
430 POKE56576,(PEEK(56576)AND2
    52)OR2:A=4:SK=-16:POKE5327
    0,PEEK(53270)OR16:PY=1
                       :rem 13
440 FORN=1TONS:GOSUB690:POKE53
    281,15:PRINT"{CLR}":POKE53
    281,0:NEXT:PY=0:A=4:SK=-16
                       :rem 154
450 POKE53282,2:POKE53283,1:GO
    SUB690:POKEV+21,3:POKEV,24
    :POKEV+1,50        :rem 247
460 POKEV+27,0:POKE53265,PEEK(
    53265)OR16:X=24:Y=50
                       :rem 150
470 J2=PEEK(56320):FR=J2AND16:
    JV=15-(J2AND15):IFJV=1THEN
    Y=Y-SE:IFY<50THENY=50
                       :rem 230
480 IFJV=2THENY=Y+SE:IFY>194TH
    ENY=194            :rem 124
490 IFJV=4THENX=X-SE:IFX<24THE
    NX=24              :rem 11
500 IFJV=8THENX=X+SE:IFX>312TH
    ENX=312            :rem 103
510 TR=(X>255):POKEV+16,(PEEK(
    V+16)AND(MM))ORTR*(MN):POK
    EV+SP*2,X+(TR*255):rem 152
520 POKEV+(SP*2)+1,Y+2:IFFR=0T
    HEN640             :rem 108
530 GETKH$:IFKH$=""THEN470
                       :rem 250
540 IFVAL(KH$)<4ANDVAL(KH$)>0T
    HENSE=8*VAL(KH$):GOTO470
                       :rem 14
550 IFKH$="-"THENCB=CB-9:IFCB<
    0THENCB=37         :rem 127
560 IFKH$="+"THENCB=CB+9:IFCB>
    37THENCB=1         :rem 127
570 IFKH$="+"ORKH$="-"THENGOSU
    B730:GOTO530       :rem 232
580 IFKH$="{RIGHT}"ORKH$="
    {LEFT}"THEN GOSUB780:GOTO4
    70                 :rem 83
590 IFASC(KH$)=20THEN640
                       :rem 116
600 IFKH$="{CLR}"THENPOKE53281
    ,15:PRINT"{CLR}":POKE53281
    ,0:GOSUB730:GOTO470
                       :rem 171
610 IFKH$="{F1}"THENGOSUB690
                       :rem 49
620 IFKH$="{F7}"THENGOSUB1260
                       :rem 95
630 GOTO470            :rem 109
640 X1=(X-24)/8:Y1=((Y-50)/8)*
    40:S=SC+X1+Y1:FORR=1TO3:FO
    RC=0TO2            :rem 172
650 P=VAL(A$(CB+CX,R))+C:IFKH$
    <>""THEN:IFASC(KH$)=20THEN
    P=32               :rem 30
660 IFP>255THENP=32    :rem 118
670 POKES+C+(R-1)*40,P:NEXT:IF
    VAL(A$(CB+CX,1))+C>185THEN
    R=3                :rem 210
680 NEXT:FR=1:GOTO470  :rem 43
690 A=A+2:SK=SK+16:IFA>12OR(A-
    6)/2=NSTHENA=6:SK=0
                       :rem 168
700 SC=BA+1024*SK/16:POKE53272
    ,(PEEK(53272)AND15)ORSK
                       :rem 23
710 POKE53272,(PEEK(53272)AND2
    40)ORA:POKE648,SC/256:IFPY
    =1THENRETURN       :rem 147
720 POKESC+1016,241:POKESC+101
    7,240:POKESC+1018,242:GOSU
    B730:RETURN        :rem 239
730 VA=0:CO=0:FORC=1TO9:CO=CO+
    1:FORR=1TO3:FORN=1TO3:P=VA
    L(A$(CB+C-1,R))-1+N:rem 61
740 IFP>255THENP=32    :rem 117
750 POKESC+880+VA+N+(C-1)*4+(R
    -1)*40,P:NEXT:IFVAL(A$(CB+
    C-1,R))-1+N>185THENN=3
                       :rem 179
760 NEXT:IFCO=9THENCO=0:VA=VA+
    120                :rem 62
770 NEXT:GOSUB800:RETURN
                       :rem 73
780 IFKH$="{LEFT}"THEN H1=H1-3
    2:CX=CX-1:IFCX<0THENCX=8:H
    1=288              :rem 159
790 IFKH$="{RIGHT}"THEN H1=H1+
    32:CX=CX+1:IFCX>8THENCX=0:
    H1=40              :rem 224
800 IFVAL(A$(CB+CX,1))+C>185TH
    ENSP=2:SV=-16:POKEV+21,6:M
    M=251:MN=-4        :rem 195
810 IFVAL(A$(CB+CX,1))+C<189TH
    ENSP=0:SV=0:POKEV+21,3:MM=
    254:MN=-1          :rem 93
820 TZ=(H1>255):POKEV+16,(PEEK
    (V+16)AND(253))ORTZ*(-2):P
    OKEV+2,H1+(TZ*255):rem 237
830 RETURN             :rem 123
840 DATA 3,252,0,7,254,0,15,25
    4,0,31             :rem 213
850 DATA 110,0,31,247,0,29,255
    ,0,55,253          :rem 113
860 DATA 128,61,191,128,59,223
    ,128,50,238,128    :rem 185
870 DATA 115,187,128,99,187,12
    8,3,185,0,3,144,0  :rem 25
880 DATA2,128,0,3,128,0,3,128,
    0,2                :rem 113
890 DATA128,0,1,0,0,0,0,0,0,0
                       :rem 147
900 DATA0,0,85,85,85,127,255,2
    53,112,0           :rem 122
910 DATA13,112,0,13,112,0,13,1
    12,0,13            :rem 28
920 DATA112,0,13,112,0,13,112,
    0,13,112           :rem 77
930 DATA0,13,112,0,13,112,0,13
                       :rem 206
940 DATA112,0,13,112,0,13,112,
    0,13,112           :rem 79
950 DATA0,13,112,0,13,112,0,13
    ,112,0             :rem 236
960 DATA13,127,255,253,85,85,8
    5,247,85,85        :rem 55
970 DATA85,106,170,169,96,0,9,
    96,0,9             :rem 50
980 DATA 96,0,9,96,0,9,96,0,9,
    106                :rem 102
990 DATA170,169,85,85,85,0,0,0
    ,0,0               :rem 183
1000 DATA0,0,0,0,0,0,0,0,0,0
                       :rem 71
1010 DATA 0,0,0,0,0,0,0,0,0,0,0
                       :rem 72
1020 DATA0,0,0,0,0,0,0,0,0,0
                       :rem 73
1030 DATA 0,0,120,173,40,3,141
     ,248,207,173      :rem 247
1040 DATA41,3,141,249,207,173,
     250,207,141,40    :rem 150
1050 DATA3,173,251,207,141,41,
     3,88,96,165       :rem 20
1060 DATA145,201,253,208,116,1
     20,169,0,133,198  :rem 2
1070 DATA32,159,255,32,228,255
     ,201,0,240,246    :rem 160
1080 DATA201,133,240,15,201,13
     4,240,23,201,135  :rem 231
1090 DATA240,31,201,136,240,84
     ,76,130,207,173   :rem 206
1100 DATA32,208,24,105,1,141,3
     2,208,76,130      :rem 42
1110 DATA 207,173,33,208,24,10
     5,1,141,33,208    :rem 96
1120 DATA 76,130,207,165,243,1
     41,252,207,165,244:rem 55
1130 DATA 141,253,207,169,0,13
     3,243,169,216,133 :rem 4
1140 DATA 244,173,134,2,24,105
     ,1,141,134,2      :rem 248
1150 DATA 162,4,160,0,145,243,
     136,208,251,202   :rem 148
1160 DATA 240,5,230,244,76,216
     ,207,173,252,207  :rem 212
1170 DATA 133,243,173,253,207,
     133,244,76,130,207:rem 56
1180 DATA 88,108,248,207,237,2
     46,123,207,2,0    :rem 121
1190 DATA 255,255      :rem 73
1200 FORI=1TOLEN(X$):POKE678+I
     ,ASC(MID$(X$,I)):NEXT
                       :rem 63
1210 POKE781,167:POKE782,2:POK
     E780,LEN(X$):SYS65469
                       :rem 236
1220 POKE780,1:POKE781,DI:POKE
     782,0:SYS65466    :rem 92
1230 POKE780,0:POKE781,0:POKE7
     82,CHSET/256:SYS65493
                       :rem 18
1240 IF(PEEK(783)AND1)OR(191AN
     DST)THENPRINT"LOAD ERROR"
     :STOP             :rem 244
1250 CLOSE1:RETURN     :rem 137
1260 POKE56578,PEEK(56578)OR3:
     POKE 56576,(PEEK(56576)AN
     D252)OR3          :rem 66
1270 POKE53270,PEEK(53270)AND2
     39:POKE53272,(PEEK(53272)
     AND15)OR16        :rem 177
1280 POKE53272,(PEEK(53272)AND
     240)OR4:XX=PEEK(V+21):POK
     EV+21,0:POKE53281,0
                       :rem 35
1290 GETK$:IFK$=""THEN1290
                       :rem 207
1300 POKE56578,PEEK(56578)OR3:
     POKE56576,(PEEK(56576)AND
     252)OR2           :rem 60
1310 POKE53270,PEEK(53270)OR16
     :POKE53272,(PEEK(53272)AN
     D15)ORSK          :rem 122
1320 POKE53272,(PEEK(53272)AND
     240)ORA:POKE53281,0:POKEV
     +21,XX:RETURN     :rem 68
```

Program 2: The Construction Set—House Character Set

```
28672 :000,000,000,000,000,000,000
28678 :000,000,000,000,000,003,009
28684 :003,000,000,000,060,060,135
28690 :060,255,255,060,060,060,000
28696 :000,000,000,192,192,000,152
28702 :000,000,081,085,081,069,090
28708 :081,069,084,069,020,085,188
28714 :069,020,085,021,081,021,083
28720 :081,069,081,069,017,085,194
28726 :069,017,017,069,106,096,172
```

```
28732 :096,096,106,096,069,005,016
28738 :170,040,040,040,170,040,054
28744 :017,069,169,009,009,009,098
28750 :169,009,017,084,085,069,255
28756 :085,021,090,091,016,085,216
28762 :021,085,105,190,235,170,128
28768 :081,084,021,085,017,085,213
28774 :165,229,021,020,085,081,191
28780 :085,021,085,084,004,085,216
28786 :021,085,085,081,085,069,028
28792 :065,085,020,085,085,020,224
28798 :085,021,017,084,085,021,183
28804 :090,024,088,088,081,081,072
28810 :085,085,170,040,040,040,086
28816 :069,068,085,081,165,037,137
28822 :037,036,000,000,000,000,223
28828 :000,000,000,000,000,000,156
28834 :000,000,000,000,000,000,162
28840 :000,000,000,000,003,015,186
28846 :051,255,040,020,020,020,068
28852 :255,255,255,063,000,000,240
28858 :000,000,255,063,255,255,246
28864 :000,000,000,000,255,063,254
28870 :255,243,000,000,000,000,184
28876 :240,060,255,255,000,000,246
28882 :000,000,000,000,000,192,146
28888 :000,000,000,000,000,000,216
28894 :000,000,084,069,085,022,226
28900 :090,091,088,027,085,097,194
28906 :169,138,206,207,000,207,137
28912 :069,085,084,085,145,149,089
28918 :149,133,000,000,000,000,016
28924 :000,000,000,000,000,000,252
28930 :000,000,000,000,000,000,002
28936 :000,000,000,000,000,001,009
28942 :006,027,060,060,060,060,031
28948 :085,170,051,207,000,000,021
28954 :000,000,000,064,144,228,206
28960 :085,081,085,069,081,084,005
28966 :069,081,068,081,021,084,186
28972 :021,084,069,084,085,081,212
28978 :069,085,017,085,069,085,204
28984 :096,096,106,085,085,106,118
28990 :096,096,040,040,170,085,077
28996 :085,170,040,040,009,009,165
29002 :169,085,085,169,009,009,088
29008 :091,091,091,091,088,091,111
29014 :091,091,255,255,247,247,248
29020 :055,055,255,255,229,037,210
29026 :229,229,229,229,229,229,192
29032 :021,084,085,021,090,024,173
29038 :088,088,085,081,085,085,110
29044 :170,040,040,040,085,068,047
29050 :085,081,165,037,037,036,051
29056 :024,088,088,024,090,085,015
29062 :021,085,040,040,040,040,144
29068 :170,085,021,085,037,037,063
29074 :037,037,164,085,020,085,062
29080 :000,000,000,000,003,015,170
29086 :170,086,003,015,060,255,235
29092 :051,255,170,149,252,207,224
29098 :252,255,051,255,170,085,214
29104 :252,255,240,255,255,063,216
29110 :170,069,252,255,243,255,146
29116 :207,255,170,084,252,255,131
29122 :243,255,207,255,170,084,128
29128 :252,255,243,255,207,255,131
29134 :170,084,240,252,243,255,170
29140 :207,255,170,084,000,000,160
29146 :000,192,048,252,170,105,217
29152 :091,091,089,073,089,089,234
29158 :026,089,207,207,101,101,193
29164 :101,101,170,101,149,145,235
29170 :149,149,148,149,133,149,095
29176 :000,000,000,000,000,000,248
29182 :000,000,000,000,000,000,254
29188 :000,000,000,001,091,091,187
29194 :091,091,088,091,090,085,034
29200 :195,195,000,000,000,243,137
29206 :170,085,229,229,229,229,169
29212 :037,229,165,085,085,081,198
29218 :069,084,069,080,085,085,250
29224 :005,081,069,084,069,085,177
29230 :069,085,081,085,017,085,212
29236 :069,081,081,085,096,096,048
29242 :096,096,096,096,106,085,121
29248 :040,040,040,040,040,040,048
29254 :170,085,009,009,009,009,105
29260 :009,009,169,085,091,091,018
29266 :091,091,089,090,106,170,207
29272 :255,255,255,255,170,170,168
29278 :170,170,229,037,229,229,134
29284 :101,165,169,170,024,088,049
29290 :088,024,090,085,021,085,243
29296 :040,040,040,040,170,085,015
29302 :021,085,037,037,037,037,116
29308 :164,085,020,085,080,085,131
29314 :021,085,085,081,085,069,044
29320 :084,085,021,085,085,081,065
29326 :085,069,085,085,021,085,060
29332 :085,081,085,069,086,085,127
29338 :085,085,084,085,085,085,151
29344 :148,149,149,148,149,149,028
29350 :145,149,085,081,085,085,028
29356 :085,069,084,085,085,081,149
29362 :085,085,085,069,084,085,159
29368 :085,081,085,085,085,069,162
29374 :084,085,085,081,085,085,183
29380 :085,069,084,085,085,081,173
29386 :085,085,085,069,084,085,183
29392 :085,081,085,085,085,069,186
29398 :084,085,105,101,101,101,023
29404 :101,101,101,101,089,089,034
29410 :089,089,090,106,085,085,002
29416 :101,101,101,101,170,170,208
29422 :085,085,149,149,149,149,236
29428 :149,165,085,085,000,000,216
29434 :000,000,000,000,000,000,250
29440 :000,000,000,000,000,000,000
29446 :000,000,000,000,000,000,006
29452 :000,000,000,000,000,000,012
29458 :000,000,000,000,000,000,018
29464 :002,001,009,005,038,027,106
29470 :155,086,128,064,096,080,127
29476 :152,228,230,149,000,000,027
29482 :000,000,000,000,000,000,042
29488 :000,000,000,000,000,000,048
29494 :000,000,000,000,000,000,054
29500 :000,000,000,000,002,003,065
29506 :011,015,047,063,190,249,129
29512 :170,255,255,255,255,255,237
29518 :191,111,170,255,255,255,035
29524 :255,255,255,255,170,255,249
29530 :255,255,255,255,250,229,053
29536 :170,255,255,255,255,255,005
29542 :255,191,170,255,255,255,203
29548 :255,255,254,249,128,192,161
29554 :224,240,248,252,190,111,099
29560 :000,000,000,000,000,000,120
29566 :000,000,149,149,149,149,210
29572 :149,149,149,149,085,080,125
29578 :080,080,085,085,085,085,126
29584 :086,086,086,086,086,086,148
29590 :086,086,000,000,000,000,066
29596 :000,000,000,000,000,000,156
29602 :000,000,000,000,000,000,162
29608 :130,105,085,085,085,085,231
29614 :085,085,000,000,000,000,088
29620 :000,000,000,000,168,047,139
29626 :047,047,032,032,032,032,152
29632 :000,000,192,240,252,015,123
29638 :003,000,021,086,090,106,248
29644 :091,091,091,091,170,170,140
29650 :170,170,255,255,195,195,170
29656 :086,149,165,169,229,229,219
29662 :229,165,168,084,084,084,012
29668 :084,084,084,084,002,001,055
29674 :001,001,001,001,001,001,240
29680 :168,084,084,084,084,084,060
29686 :084,084,000,000,000,000,158
29692 :000,000,000,000,000,000,252
29698 :000,000,000,000,000,000,002
29704 :000,000,000,000,000,000,008
29710 :000,000,002,001,009,001,027
29716 :037,021,149,086,085,085,227
29722 :086,086,091,111,191,213,036
29728 :085,085,149,149,229,249,210
29734 :254,087,128,064,096,080,235
29740 :088,084,086,149,000,000,195
29746 :000,000,000,000,000,000,050
29752 :002,003,011,015,047,063,197
29758 :191,170,249,249,249,250,140
29764 :234,255,255,170,111,111,180
29770 :111,175,171,255,255,170,187
29776 :255,255,255,255,255,255,074
29782 :255,170,229,229,229,234,152
29788 :170,255,255,170,191,191,044
29794 :191,191,175,255,255,170,055
29800 :249,249,249,250,234,255,054
29806 :255,170,111,111,111,175,019
29812 :171,255,255,170,128,192,007
29818 :224,240,248,252,254,170,230
29824 :149,149,149,149,149,149,254
29830 :149,149,005,005,005,085,020
29836 :085,085,085,080,086,086,135
29842 :086,086,086,086,086,086,150
29848 :000,000,000,000,000,000,152
29854 :000,000,000,000,000,000,158
29860 :000,000,000,000,069,069,046
29866 :069,085,085,085,085,081,148
29872 :000,000,002,001,001,001,181
29878 :001,001,032,032,034,169,195
29884 :169,101,085,085,000,000,116
29890 :000,000,000,000,000,000,194
29896 :091,091,091,091,091,088,231
29902 :091,091,195,195,195,255,204
29908 :255,063,063,255,229,229,026
29914 :229,229,229,229,229,229,056
29920 :084,086,085,085,084,084,220
29926 :084,084,001,169,085,085,226
29932 :085,085,085,085,084,084,232
29938 :084,084,084,084,084,020,170
29944 :000,000,000,000,000,000,248
29950 :000,000,000,000,000,000,254
29956 :000,000,000,000,002,001,007
29962 :009,006,043,175,175,170,076
29968 :091,109,189,253,253,255,142
29974 :255,170,106,104,104,096,089
29980 :096,085,255,170,169,041,076
29986 :041,009,009,085,255,170,091
29992 :229,121,126,127,127,255,001
29998 :255,170,128,064,096,144,135
30004 :232,248,254,170,085,085,102
30010 :086,089,101,149,085,170,226
30016 :101,153,086,085,085,085,147
30022 :085,170,085,085,085,149,217
30028 :101,089,086,170,085,085,180
30034 :086,089,101,149,085,170,250
30040 :101,153,086,085,085,085,171
30046 :085,170,085,085,085,149,241
30052 :101,089,086,170,085,085,204
30058 :086,089,101,149,085,170,018
30064 :101,153,086,085,085,085,195
30070 :085,170,085,085,085,149,009
30076 :101,089,086,170,149,149,100
30082 :149,149,149,149,149,149,000
30088 :080,080,080,085,085,085,119
30094 :085,085,086,086,086,086,144
30100 :086,086,086,086,160,080,220
30106 :080,085,085,085,085,085,147
30112 :160,080,080,085,085,085,223
30118 :085,085,081,081,081,085,152
30124 :085,085,085,085,001,001,002
30130 :001,001,001,001,001,001,184
30136 :085,085,085,085,085,085,182
30142 :085,085,000,000,000,000,104
30148 :000,000,000,000,091,091,122
30154 :091,091,090,090,105,165,066
30160 :255,255,255,255,150,085,183
30166 :105,170,229,165,229,229,061
30172 :165,165,105,090,068,069,114
30178 :069,069,069,069,085,085,160
30184 :085,085,085,085,085,085,230
30190 :085,085,020,020,020,020,232
30196 :084,084,084,084,000,000,068
30202 :000,000,000,000,000,000,250
30208 :000,000,000,000,000,000,000
30214 :000,000,136,136,170,136,072
30220 :136,170,136,136,136,136,094
30226 :170,136,136,170,136,136,134
30232 :136,136,170,136,136,170,140
30238 :136,136,188,191,143,191,247
30244 :191,143,191,143,000,195,131
30250 :235,235,235,000,235,235,193
30256 :062,254,242,254,254,242,076
30262 :254,254,170,191,191,191,025
30268 :130,128,128,170,170,235,253
30274 :235,232,040,040,040,170,055
30280 :170,254,254,034,002,002,020
30286 :002,170,085,085,086,089,083
30292 :101,149,149,170,105,150,140
30298 :085,125,255,125,085,170,167
30304 :085,085,149,101,089,086,179
30310 :086,170,170,149,149,149,207
30316 :180,156,144,170,170,085,245
30322 :065,000,000,000,000,170,093
30328 :170,086,086,086,030,054,120
30334 :006,170,002,001,001,169,219
30340 :085,085,085,085,160,080,200
30346 :080,090,085,085,085,085,136
30352 :042,021,021,149,085,085,035
30358 :085,085,085,021,085,084,083
30364 :085,021,085,085,085,021,026
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30370 :085,084,085,021,085,085,095
30376 :085,021,085,084,085,021,037
30382 :085,085,170,170,168,170,254
30388 :042,168,170,170,170,170,046
30394 :168,170,042,168,170,170,050
30400 :170,042,168,170,170,170,058
30406 :138,170,252,255,255,255,243
30412 :063,255,255,243,255,255,250
30418 :255,255,063,255,255,243,000
30424 :255,243,255,255,063,255,006
30430 :255,243,085,086,091,111,069
30436 :111,191,191,191,169,254,055
30442 :255,255,255,255,255,255,228
30448 :084,084,148,228,228,248,236
30454 :248,248,000,000,000,000,230
30460 :000,000,000,000,000,000,252
30466 :000,000,000,000,000,000,002
30472 :000,000,003,015,063,255,088
30478 :170,085,060,255,255,255,070
30484 :255,255,170,085,000,000,017
30490 :192,240,252,255,170,085,196
30496 :160,160,170,165,165,166,250
30502 :168,160,000,000,170,105,129
30508 :130,000,000,000,010,010,194
30514 :170,090,090,154,042,010,094
30520 :160,160,160,160,160,160,248
30526 :160,160,000,000,000,000,126
30532 :000,000,000,000,010,010,088
30538 :010,010,010,010,010,010,134
30544 :000,000,000,000,000,000,080
30550 :000,000,085,085,085,085,170
30556 :085,085,085,085,064,064,048
30562 :064,064,064,064,064,064,226
30568 :170,128,128,128,128,128,146
30574 :128,170,170,000,000,000,066
30580 :000,000,000,170,170,002,202
30586 :002,002,002,002,002,170,046
30592 :000,000,000,000,010,170,052
30598 :165,085,000,000,010,170,052
30604 :165,085,081,085,010,170,224
30610 :165,081,085,069,085,085,204
30616 :160,170,090,085,021,081,247
30622 :085,085,000,000,160,170,146
30628 :090,085,021,085,000,000,189
30634 :000,000,160,170,090,021,099
30640 :000,000,000,002,001,011,190
30646 :039,189,040,190,125,215,212
30652 :255,125,215,255,000,000,014
30658 :000,128,064,224,216,126,184
30664 :002,000,000,000,000,000,202
30670 :000,000,160,191,189,189,167
30676 :131,128,128,128,000,000,215
30682 :240,240,240,000,000,000,170
30688 :191,191,191,111,111,091,086
30694 :086,085,255,255,255,255,141
30700 :255,255,254,169,248,248,129
30706 :248,228,228,148,084,084,238
30712 :000,000,000,000,000,000,248
30718 :000,013,013,013,013,013,063
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Program 3: The Construction Set—Creature Character Set

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28672 :000,000,000,000,000,000,000
28678 :000,000,000,000,000,003,009
28684 :003,015,005,010,000,048,093
28690 :252,255,255,255,085,170,010
28696 :000,000,000,000,000,192,216
28702 :064,128,000,000,000,001,223
28708 :005,063,085,010,020,085,048
28714 :085,105,085,255,085,170,059
28720 :000,000,000,064,080,252,188
28726 :085,160,000,003,015,015,076
28732 :063,062,042,234,255,255,203
28738 :255,255,255,255,190,170,166
28744 :000,192,240,240,252,188,160
28750 :168,171,012,035,000,000,208
28756 :001,005,021,021,000,000,132
28762 :215,105,085,085,085,085,238
28768 :048,200,000,000,064,080,232
28774 :084,084,053,213,080,074,178
28780 :200,192,240,255,255,125,095
28786 :085,060,060,060,234,234,079
28792 :092,087,005,163,035,003,249
28798 :015,255,170,128,128,131,185
28804 :143,143,143,143,170,000,106
28810 :000,255,255,255,255,255,133
28816 :170,002,002,194,242,242,228
28822 :242,242,000,000,000,002,124
28828 :002,009,009,009,042,170,141
28834 :170,170,170,008,008,089,009
28840 :000,128,128,160,160,024,000
28846 :024,088,000,003,013,013,059
28852 :013,010,010,063,213,085,062
28858 :085,085,085,170,170,255,012
28864 :085,201,122,122,112,160,226
28870 :160,252,000,003,015,063,179
28876 :063,048,048,048,255,255,153
28882 :255,255,063,063,012,012,102
28888 :240,252,255,255,207,003,148
28894 :003,003,000,000,001,005,234
28900 :021,085,085,020,021,085,033
28906 :085,085,085,085,085,020,167
28912 :000,064,080,084,084,085,125
28918 :085,020,000,000,000,000,095
28924 :000,000,000,000,000,000,252
28930 :000,000,000,000,000,000,002
28936 :011,010,032,040,042,034,177
28942 :008,010,239,254,100,100,213
28948 :154,154,152,254,192,128,030
28954 :032,160,160,032,128,128,154
28960 :037,170,160,161,042,042,132
28966 :010,010,235,125,040,105,051
28972 :170,190,130,170,088,170,194
28978 :010,074,168,168,168,168,038
28984 :233,249,250,251,254,255,012
28990 :062,058,170,170,190,255,199
28996 :255,150,170,169,107,111,006
29002 :175,239,191,255,188,172,014
29008 :021,087,086,085,021,023,147
29014 :005,001,085,215,150,125,155
29020 :255,000,255,125,084,213,000
29026 :149,085,084,208,080,064,000
29032 :255,254,254,255,061,061,220
29038 :053,023,170,170,157,085,000
29044 :085,105,106,170,191,175,180
29050 :175,127,092,092,084,180,104
29056 :143,143,143,143,131,128,191
29062 :136,170,255,255,255,255,180
29068 :255,130,000,170,242,242,155
29074 :242,242,194,002,034,170,006
29080 :002,002,000,000,000,000,156
29086 :000,000,153,162,162,170,037
29092 :128,042,042,008,161,161,194
29098 :128,128,128,000,000,000,042
29104 :063,042,255,191,173,175,051
29110 :171,169,191,175,174,110,148
29116 :125,255,215,170,188,172,033
29122 :191,126,122,250,250,106,215
29128 :048,060,015,015,015,015,112
29134 :015,015,012,015,015,063,085
29140 :240,252,207,003,003,015,164
29146 :012,204,252,252,252,060,226
29152 :020,005,005,005,005,001,009
29158 :001,001,215,004,085,081,105
29164 :081,150,255,085,020,080,139
29170 :080,080,080,064,064,064,162
29176 :000,000,000,000,000,000,248
29182 :000,000,000,000,000,000,254
29188 :000,000,000,000,015,050,069
29194 :002,003,003,013,063,063,157
29200 :223,086,170,171,239,253,134
29206 :087,255,192,240,000,000,028
29212 :000,192,252,252,002,002,216
29218 :003,003,013,053,021,021,148
29224 :042,128,170,234,255,076,177
29230 :085,117,032,160,176,240,088
29236 :208,092,084,085,014,003,026
29242 :000,003,063,063,255,255,185
29248 :150,170,255,255,255,255,124
29254 :255,255,176,192,000,192,116
29260 :252,252,255,255,002,005,073
29266 :023,085,087,095,127,127,114
29272 :085,150,105,215,215,125,215
29278 :255,255,128,080,212,085,085
29284 :213,245,253,253,000,000,040
29290 :003,015,063,243,251,235,148
29296 :060,255,255,255,255,255,167
29302 :255,255,000,000,192,240,036
29308 :252,207,239,235,000,000,033
29314 :000,000,000,000,003,015,148
29320 :040,040,040,040,040,235,059
29326 :239,255,000,000,000,000,124
29332 :000,000,192,240,000,008,076
29338 :034,032,034,032,032,032,094
29344 :170,000,008,128,042,128,124
29350 :042,128,128,040,034,130,156
29356 :034,130,032,130,171,042,199
29362 :042,042,010,010,022,022,070
29368 :085,215,255,190,170,170,245
29374 :170,170,232,168,168,168,242
29380 :160,160,144,148,003,000,043
29386 :000,000,000,002,009,009,222
29392 :192,252,127,031,149,086,021
29398 :088,088,012,048,240,064,242
29404 :128,000,000,000,034,034,160
29410 :033,034,034,034,034,034,173
29416 :085,150,170,170,105,105,249
29422 :085,105,136,136,072,136,140
29428 :136,136,136,136,000,000,020
29434 :000,000,000,000,000,000,250
29440 :000,000,000,000,000,000,000
29446 :000,000,243,243,060,060,100
29452 :015,013,015,002,223,255,023
29458 :223,255,125,223,255,171,246
29464 :255,207,060,060,240,112,190
29470 :240,192,085,081,085,021,222
29476 :023,014,006,001,085,093,002
29482 :085,117,085,093,085,085,080
29488 :085,085,069,069,084,124,052
29494 :160,064,255,243,243,240,235
29500 :252,060,062,014,255,255,190
29506 :255,255,255,255,255,255,060
29512 :255,255,207,207,207,060,239
29518 :188,176,127,095,023,005,180
29524 :002,000,000,003,255,255,087
29530 :255,255,191,063,127,213,170
29536 :253,245,212,208,160,000,150
29542 :064,240,176,160,040,010,024
29548 :130,160,164,166,255,255,214
29554 :255,190,170,040,000,130,131
29560 :014,010,040,160,130,010,228
29566 :026,154,060,060,015,003,188
29572 :000,000,000,000,170,170,216
29578 :170,235,175,190,186,170,240
29584 :060,060,240,192,000,000,184
29590 :000,000,000,008,008,008,174
29596 :000,000,010,010,008,162,090
29602 :008,162,008,162,136,000,126
29608 :002,130,000,130,000,128,046
29614 :168,040,085,085,085,081,206
29620 :081,081,081,081,170,105,011
29626 :085,085,105,085,105,085,224
29632 :085,085,085,085,069,069,158
29638 :069,069,037,009,009,002,137
29644 :002,000,000,000,088,088,126
29650 :088,090,086,149,149,037,041
29656 :000,000,000,000,128,128,216
29662 :128,096,033,034,034,034,069
29668 :034,034,034,087,105,105,115
29674 :105,170,150,170,170,170,145
29680 :072,136,136,136,136,136,224
29686 :136,196,000,000,000,000,066
29692 :000,000,000,000,000,000,252
29698 :000,000,000,000,000,000,002
29704 :015,015,015,015,015,015,098
29710 :015,015,254,255,207,207,199
29716 :207,207,003,003,160,248,080
29722 :248,242,192,192,192,192,004
29728 :001,000,005,021,053,213,069
29734 :213,213,085,040,085,085,247
29740 :085,085,085,065,000,000,108
29746 :080,084,092,087,087,087,055
29752 :014,002,003,015,015,063,168
29758 :063,063,191,255,255,255,120
29764 :255,255,195,003,160,192,104
29770 :240,240,240,252,252,252,014
29776 :015,063,015,015,003,000,191
29782 :000,000,255,255,255,255,082
29788 :255,255,255,063,252,255,147
29794 :252,252,240,192,192,000,202
29800 :166,166,038,006,130,160,002
29806 :164,166,166,166,166,166,080
29812 :166,036,000,130,154,154,244
29818 :152,144,130,010,026,154,226
29824 :000,010,009,009,010,009,175
29830 :009,009,170,170,085,085,150
29836 :170,085,085,085,000,160,213
29842 :096,096,160,096,096,096,018
29848 :002,000,002,008,008,008,180
29854 :008,008,000,162,008,000,088
29860 :000,000,000,000,032,128,068
29866 :032,008,008,008,008,008,242
29872 :165,245,053,005,000,005,137
29878 :005,005,105,085,105,065,040
29884 :000,085,085,081,090,095,112
29890 :092,080,000,080,080,080,094
29896 :000,000,000,000,001,004,205
29902 :017,065,009,002,000,000,043
29908 :020,084,105,128,096,088,221
29914 :150,150,150,152,152,088,036
29920 :023,019,007,003,003,003,026
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29926 :003,003,255,255,195,195,112
29932 :195,195,195,195,213,212,161
29938 :196,192,192,192,192,192,118
29944 :000,000,000,000,000,000,248
29950 :000,000,000,000,000,000,254
29956 :000,000,000,000,015,060,079
29962 :060,060,060,060,060,000,054
29968 :003,003,003,003,000,000,028
29974 :000,000,192,192,192,192,022
29980 :240,240,240,000,005,005,246
29986 :001,001,005,005,005,005,056
29992 :065,065,065,065,000,000,044
29998 :000,000,095,127,127,127,010
30004 :083,080,080,080,252,240,099
30010 :240,240,060,060,060,063,013
30016 :000,000,000,000,000,000,064
30022 :003,003,255,063,015,063,216
30028 :252,240,240,192,000,000,232
30034 :000,000,003,015,015,002,117
30040 :063,063,255,255,255,243,198
30046 :243,128,000,000,192,192,081
30052 :240,252,252,160,166,166,056
30058 :038,006,128,160,010,000,192
30064 :166,166,166,166,166,000,174
30070 :002,168,154,154,152,128,108
30076 :002,040,128,000,010,009,057
30082 :009,010,000,002,002,000,153
30088 :170,085,085,170,128,034,040
30094 :034,128,160,096,096,160,048
30100 :128,032,032,128,008,000,220
30106 :002,002,002,002,002,000,164
30112 :000,000,000,000,000,000,160
30118 :000,128,008,000,032,032,110
30124 :032,032,032,128,001,001,142
30130 :001,001,001,001,001,004,187
30136 :064,064,064,064,064,064,056
30142 :001,001,080,080,080,080,000
30148 :080,080,064,000,020,085,013
30154 :088,100,097,024,022,005,026
30160 :086,129,006,018,073,165,173
30166 :022,104,088,088,080,096,180
30172 :096,128,000,000,003,003,194
30178 :003,003,001,001,001,005,240
30184 :195,195,195,195,065,065,118
30190 :065,085,192,192,192,192,132
30196 :064,064,064,080,000,000,004
30202 :000,000,000,000,000,000,250
30208 :000,000,000,000,000,000,000
30214 :000,000,000,000,000,000,006
30220 :002,002,002,042,000,000,060
30226 :000,170,170,170,150,170,080
30232 :000,000,000,000,128,128,024
30238 :128,168,000,000,000,000,070
30244 :000,000,255,255,063,255,096
30250 :255,255,251,234,255,255,011
30256 :000,192,192,192,192,192,240
30262 :255,255,000,000,000,003,055
30268 :013,013,010,010,013,053,172
30274 :087,087,085,085,170,170,238
30280 :192,240,010,010,192,112,060
30286 :160,160,000,000,000,001,143
30292 :001,007,085,085,020,085,111
30298 :085,085,084,085,255,085,001
30304 :000,000,000,064,064,208,176
30310 :085,085,004,005,005,005,035
30316 :005,005,005,005,065,065,002
30322 :065,065,065,065,065,065,248
30328 :016,080,080,080,080,080,024
30334 :080,080,015,003,003,003,054
30340 :003,003,003,003,192,000,080
30346 :000,000,000,000,000,000,138
30352 :252,048,048,048,048,048,124
30358 :048,048,160,240,240,224,086
30364 :240,251,255,207,000,000,085
30370 :000,000,000,000,195,195,040
30376 :010,015,015,011,015,239,217
30382 :255,243,255,255,255,255,156
30388 :255,255,255,255,255,255,174
30394 :247,255,255,247,255,255,164
30400 :255,255,255,255,255,255,186
30406 :255,255,085,085,085,085,024
30412 :085,085,085,085,089,085,206
30418 :085,089,085,089,085,085,216
30424 :085,085,085,085,085,085,214
30430 :085,085,170,128,170,128,220
30436 :170,128,170,170,170,000,012
30442 :170,000,170,000,170,170,146
30448 :170,002,170,002,170,002,244
30454 :170,170,000,000,000,000,074
30460 :000,000,000,000,000,000,252
30466 :000,000,000,000,000,000,002
30472 :000,002,002,002,002,002,018
30478 :002,010,000,170,153,153,246
30484 :153,153,153,170,000,128,009
30490 :128,128,128,128,128,160,058
30496 :130,040,010,034,130,000,120
30502 :000,002,032,008,002,032,114
30508 :128,130,136,160,032,128,246
30514 :136,034,168,000,000,000,132
30520 :000,000,000,000,000,000,056
30526 :000,002,170,170,170,170,232
30532 :170,170,170,170,000,000,236
30538 :000,000,000,000,000,128,202
30544 :010,011,011,011,011,010,144
30550 :011,042,170,174,238,250,203
30556 :254,254,174,170,000,000,176
30562 :000,000,000,000,000,128,226
30568 :012,015,015,015,014,015,190
30574 :252,252,195,195,195,227,146
30580 :138,195,195,195,048,240,103
30586 :240,176,240,240,063,063,120
30592 :000,003,003,003,003,015,155
30598 :051,195,000,000,000,000,124
30604 :000,192,051,051,000,048,226
30610 :048,048,048,240,060,051,129
30616 :000,000,000,000,003,004,159
30622 :012,008,015,063,061,255,060
30628 :204,068,204,136,000,192,200
30634 :192,240,204,068,204,136,190
30640 :012,063,062,002,000,000,059
30646 :000,000,000,000,000,000,182
30652 :128,032,034,008,015,063,212
30658 :059,008,032,128,000,000,165
30664 :021,005,005,005,005,005,246
30670 :005,004,065,065,065,065,219
30676 :065,065,065,065,080,080,120
30682 :080,080,080,080,080,016,122
30688 :000,000,000,000,003,013,240
30694 :001,000,192,192,000,192,039
30700 :240,220,208,192,012,012,096
30706 :000,012,063,221,029,012,067
30712 :000,000,000,000,000,192,184
30718 :000,013,013,013,013,013,063
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Program 4: The Construction Set—Shapes Character Set

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28672 :000,000,000,000,000,000,000
28678 :000,000,170,170,160,160,154
28684 :160,160,160,160,170,170,224
28690 :000,000,000,000,000,000,018
28696 :170,170,010,010,010,010,148
28702 :010,010,170,170,170,170,218
28708 :170,170,170,170,170,170,032
28714 :170,170,170,170,170,170,038
28720 :170,170,170,170,170,170,044
28726 :170,170,085,085,085,085,222
28732 :085,085,085,085,085,085,058
28738 :085,085,085,085,085,085,064
28744 :085,085,085,085,085,085,070
28750 :085,085,255,255,255,255,244
28756 :255,255,255,255,255,255,078
28762 :255,255,255,255,255,255,084
28768 :255,255,255,255,255,255,090
28774 :255,255,255,255,240,240,066
28780 :240,240,240,240,255,255,042
28786 :060,060,060,060,060,060,218
28792 :255,255,015,015,015,015,178
28798 :015,015,000,000,000,000,156
28804 :000,000,000,000,012,012,156
28810 :012,063,063,063,255,255,081
28816 :000,000,000,000,000,000,144
28822 :192,192,000,000,000,000,022
28828 :000,000,000,002,032,032,222
28834 :032,032,032,032,168,086,032
28840 :000,000,000,000,000,000,168
28846 :000,000,032,038,038,038,064
28852 :038,038,038,038,000,000,076
28858 :064,102,102,102,102,102,248
28864 :002,038,102,102,102,102,128
28870 :102,102,000,000,000,000,146
28876 :000,000,000,000,004,004,212
28882 :004,012,012,012,012,012,018
28888 :000,000,000,000,000,000,216
28894 :000,000,000,000,000,000,222
28900 :000,000,000,000,020,020,012
28906 :020,020,020,020,020,020,098
28912 :000,000,000,000,000,000,240
28918 :000,000,000,000,000,000,246
28924 :000,000,000,000,000,000,252
28930 :000,000,000,000,000,000,002
28936 :160,160,160,160,160,160,200
28942 :160,160,000,000,000,000,078
28948 :000,000,000,000,010,010,040
28954 :010,010,010,010,010,010,086
28960 :170,170,170,170,170,170,028
28966 :170,170,170,170,170,170,034
28972 :170,170,170,170,170,170,040
28978 :170,170,170,170,170,170,046
28984 :085,085,085,085,085,085,054
28990 :085,085,085,085,085,085,060
28996 :085,085,085,085,085,085,066
29002 :085,085,085,085,085,085,072
29008 :255,255,255,255,255,255,074
29014 :255,255,255,255,255,255,080
29020 :255,255,255,255,255,255,086
29026 :255,255,255,255,255,255,092
29032 :240,240,240,255,240,240,023
29038 :240,240,060,060,060,255,001
29044 :060,060,060,060,060,015,015,130
29050 :015,255,015,015,015,015,196
29056 :000,003,003,003,015,003,155
29062 :003,003,255,255,255,255,136
29068 :255,255,255,255,192,240,056
29074 :240,240,252,240,240,240,062
29080 :009,037,150,090,105,105,136
29086 :105,090,101,169,154,086,095
29092 :085,101,085,086,128,096,233
29098 :088,148,164,165,164,148,023
29104 :038,038,038,038,038,038,148
29110 :038,038,102,102,102,102,154
29116 :102,102,102,102,102,102,032
29122 :102,102,102,102,102,102,038
29128 :010,009,009,009,255,009,245
29134 :009,009,174,093,093,127,199
29140 :247,127,093,093,168,088,004
29146 :088,088,255,088,088,088,145
29152 :000,000,000,000,085,085,138
29158 :000,000,020,020,020,020,054
29164 :085,085,020,020,000,000,190
29170 :000,000,085,085,000,000,156
29176 :000,000,000,000,000,000,248
29182 :000,000,000,000,000,000,254
29188 :000,000,000,000,160,160,068
29194 :160,160,160,160,170,170,222
29200 :000,000,000,000,000,000,016
29206 :170,170,010,010,010,010,146
29212 :010,010,170,170,170,170,216
29218 :170,170,170,170,170,170,030
29224 :170,170,170,170,170,170,036
29230 :170,170,170,170,170,170,042
29236 :170,170,170,170,085,085,134
29242 :085,085,085,085,085,085,056
29248 :085,085,085,085,085,085,062
29254 :085,085,085,085,085,085,068
29260 :085,085,085,085,255,255,158
29266 :255,255,255,255,255,255,076
29272 :255,255,255,255,255,255,082
29278 :255,255,255,255,255,255,088
29284 :255,255,255,255,240,240,064
29290 :240,240,240,240,255,255,040
29296 :060,060,060,060,060,060,216
29302 :255,255,015,015,015,015,176
29308 :015,015,255,255,000,000,152
29314 :000,000,000,000,000,000,130
29320 :255,255,255,063,063,063,066
29326 :012,012,192,192,192,000,230
29332 :000,000,000,000,150,037,079
29338 :009,002,000,000,000,000,165
29344 :154,169,101,086,168,032,102
29350 :032,032,088,096,128,000,030
29356 :000,000,000,000,038,038,248
29362 :038,038,038,038,038,038,150
29368 :102,102,102,102,102,102,028
29374 :102,102,102,102,102,102,034
29380 :102,102,102,102,010,000,102
29386 :000,000,000,000,000,000,202
29392 :174,012,012,012,012,012,186
29398 :004,004,168,000,000,000,134
29404 :000,000,000,000,000,000,220
29410 :000,000,000,000,000,000,226
29416 :020,020,020,020,020,020,096
29422 :020,020,000,000,000,000,022
29428 :000,000,000,000,000,000,244
29434 :000,000,000,000,000,000,250
29440 :000,000,000,000,000,000,000
29446 :000,000,085,085,000,000,176
29452 :085,085,000,000,085,085,096
29458 :000,000,085,085,000,000,188
29464 :085,085,000,000,085,085,108
29470 :000,000,255,255,000,000,028
29476 :255,255,000,000,255,255,032
29482 :000,000,255,255,000,000,040
```

```
29488 :255,255,000,000,255,255,044
29494 :000,000,170,170,000,000,138
29500 :170,170,000,000,170,170,228
29506 :000,000,170,170,000,000,150
29512 :170,170,000,000,170,170,240
29518 :000,000,128,000,032,000,238
29524 :008,000,002,000,000,000,094
29530 :000,000,000,000,000,000,090
29536 :002,000,008,000,032,000,138
29542 :128,000,000,000,010,170,154
29548 :042,002,000,000,010,170,076
29554 :168,000,160,170,042,000,142
29560 :170,128,000,000,000,000,162
29566 :160,170,170,255,255,170,026
29572 :255,255,170,252,170,255,209
29578 :255,170,255,255,170,204,167
29584 :170,255,255,170,255,255,224
29590 :170,255,000,000,000,000,063
29596 :000,000,000,000,000,000,156
29602 :000,000,000,000,000,000,162
29608 :000,001,001,005,005,021,201
29614 :021,085,000,064,064,080,232
29620 :080,084,084,085,000,000,001
29626 :000,000,000,000,000,000,186
29632 :000,000,000,000,000,000,192
29638 :000,000,000,000,000,000,198
29644 :002,002,010,010,036,036,044
29650 :165,165,165,165,165,165,176
29656 :000,000,000,000,064,064,088
29662 :080,080,170,191,063,047,085
29668 :015,011,003,002,170,255,172
29674 :255,255,255,255,255,255,228
29680 :170,254,252,248,240,224,092
29686 :192,128,000,000,000,000,054
29692 :000,000,000,000,000,000,252
29698 :000,000,000,000,000,000,002
29704 :085,085,000,000,085,085,092
29710 :000,000,085,085,000,000,184
29716 :085,085,000,000,085,085,104
29722 :000,000,085,085,000,000,196
29728 :255,255,000,000,255,255,028
29734 :000,000,255,255,000,000,036
29740 :255,255,000,000,255,255,040
29746 :000,000,255,255,000,000,048
29752 :170,170,000,000,170,170,224
29758 :000,000,170,170,000,000,146
29764 :170,170,000,000,170,170,236
29770 :000,000,170,170,000,000,158
29776 :000,000,000,000,000,000,080
29782 :000,000,130,000,040,000,000
29788 :040,000,130,000,000,000,006
29794 :000,000,000,000,000,000,098
29800 :000,000,010,170,042,002,072
29806 :000,000,010,170,168,000,202
29812 :160,170,042,002,168,128,018
29818 :000,000,000,000,160,170,196
29824 :252,168,252,252,168,252,192
29830 :252,168,204,136,204,204,022
29836 :136,204,204,136,255,170,221
29842 :255,255,170,255,255,170,226
29848 :000,000,000,000,000,000,152
29854 :000,000,000,001,001,005,165
29860 :005,021,021,085,085,085,210
29866 :085,085,085,085,085,085,168
29872 :085,085,085,085,085,085,174
29878 :085,085,000,064,064,080,048
29884 :080,084,084,085,000,000,009
29890 :000,000,000,000,000,000,194
29896 :042,042,170,170,170,085,111
29902 :085,021,165,165,165,165,204
29908 :165,090,090,090,084,084,047
29914 :085,085,085,170,170,168,213
29920 :000,000,000,000,000,000,224
29926 :000,000,255,190,060,060,027
29932 :060,060,060,190,000,000,094
29938 :000,000,000,000,000,000,242
29944 :000,000,000,000,000,000,248
29950 :000,000,000,000,000,000,254
29956 :000,000,000,000,085,085,174
29962 :000,000,085,085,000,000,180
29968 :085,085,000,000,085,085,100
29974 :000,000,085,085,000,000,192
29980 :085,085,000,000,255,255,196
29986 :000,000,255,255,000,000,032
29992 :255,255,000,000,255,255,036
29998 :000,000,255,255,000,000,044
30004 :255,255,000,000,170,170,134
30010 :000,000,170,170,000,000,142
30016 :170,170,000,000,170,170,232
30022 :000,000,170,170,000,000,154
30028 :170,170,000,000,002,000,162
30034 :008,000,032,000,128,000,250
30040 :000,000,000,000,000,000,088
30046 :000,000,128,000,032,000,254
30052 :008,000,002,000,000,000,110
30058 :010,170,042,002,000,000,074
30064 :010,170,168,128,160,170,150
30070 :042,002,168,128,000,000,202
30076 :000,000,160,170,252,252,190
30082 :170,255,255,170,255,170,125
30088 :204,204,170,255,255,170,114
30094 :255,170,255,255,170,255,222
30100 :255,170,255,170,000,001,231
30106 :001,005,005,021,021,085,036
30112 :085,085,085,085,085,085,158
30118 :085,085,085,085,085,085,164
30124 :085,085,085,085,085,085,170
30130 :085,085,085,085,085,085,176
30136 :085,085,085,085,085,085,182
30142 :085,085,000,064,064,080,056
30148 :080,084,084,085,021,005,043
30154 :005,001,001,000,000,000,209
30160 :090,090,090,090,090,090,236
30166 :090,024,168,160,160,128,176
30172 :128,000,000,000,000,002,094
30178 :003,011,015,047,063,170,023
30184 :255,255,255,255,255,255,226
30190 :255,170,000,128,192,224,183
30196 :240,248,252,170,000,000,130
30202 :000,000,000,000,000,000,250
30208 :000,000,000,000,000,000,000
30214 :000,000,255,002,002,002,011
30220 :002,002,002,002,255,085,104
30226 :085,085,085,085,085,085,016
30232 :255,128,128,128,128,128,151
30238 :128,128,000,000,003,015,048
30244 :015,063,063,255,060,255,235
30250 :255,255,255,215,215,085,042
30256 :000,000,192,240,240,252,204
30262 :252,255,192,192,192,234,091
30268 :213,213,213,213,000,000,144
30274 :000,170,085,085,085,085,064
30280 :003,003,003,171,087,087,170
30286 :087,087,160,160,170,160,134
30292 :160,170,160,160,000,000,222
30298 :170,000,000,170,000,000,174
30304 :010,010,170,010,010,170,220
30310 :010,010,000,000,000,000,122
30316 :002,008,032,128,000,000,022
30322 :040,170,000,000,000,000,068
30328 :000,000,000,000,128,032,024
30334 :008,002,240,092,092,092,140
30340 :087,087,087,085,000,000,222
30346 :000,000,000,000,000,195,077
30352 :015,053,053,053,213,213,232
30358 :213,085,085,064,064,064,213
30364 :064,064,064,085,085,000,006
30370 :000,000,000,000,000,085,247
30376 :085,001,001,001,001,001,002
30382 :001,085,128,128,170,128,046
30388 :170,128,170,128,000,000,008
30394 :170,000,170,000,170,000,184
30400 :002,002,170,002,170,002,028
30406 :170,002,238,187,238,187,196
30412 :238,187,238,187,238,187,199
30418 :238,187,238,187,238,187,205
30424 :238,187,238,187,238,187,211
30430 :238,187,004,085,004,004,232
30436 :085,004,004,085,016,085,251
30442 :016,016,085,016,016,085,212
30448 :065,085,065,065,085,065,158
30454 :065,085,000,000,000,000,140
30460 :000,000,000,000,000,000,252
30466 :000,000,000,000,000,000,002
30472 :002,002,002,002,002,002,020
30478 :002,255,085,085,085,085,099
30484 :085,085,085,255,128,128,018
30490 :128,128,128,128,128,255,153
30496 :253,255,063,063,015,003,172
30502 :000,000,085,085,215,215,126
30508 :255,255,255,060,127,255,227
30514 :252,252,240,192,000,000,218
30520 :213,213,213,213,234,192,054
30526 :192,192,085,085,085,085,018
30532 :170,000,000,000,087,087,156
30538 :087,087,171,003,003,003,172
30544 :170,160,160,170,160,160,036
30550 :170,160,170,000,000,170,244
30556 :000,000,170,000,170,010,186
30562 :010,170,010,010,170,010,222
30568 :128,128,032,008,002,000,146
30574 :000,000,000,000,000,000,110
30580 :000,170,040,000,002,002,074
30586 :008,032,128,000,000,000,034
30592 :085,085,087,087,087,092,139
30598 :092,252,125,195,000,000,030
30604 :000,000,000,000,085,085,054
30610 :213,213,213,053,053,063,186
30616 :255,192,192,192,192,192,087
30622 :192,255,255,000,000,000,092
30628 :000,000,000,255,255,003,165
30634 :003,003,003,003,003,255,184
30640 :170,128,128,128,128,128,218
30646 :128,170,170,000,000,000,138
30652 :000,000,000,170,170,002,018
30658 :002,002,002,002,002,170,118
30664 :102,153,102,153,102,153,197
30670 :102,153,102,153,102,153,203
30676 :102,153,102,153,102,153,209
30682 :102,153,102,153,102,153,215
30688 :012,012,255,012,012,255,014
30694 :012,012,048,048,255,048,141
30700 :048,255,048,048,195,195,001
30706 :255,195,195,255,195,195,252
30712 :000,000,000,000,000,000,248
30718 :000,013,013,013,013,013,063
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All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

SpeedCheck

See instructions in article on page 64 before typing in.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: Dictionary Manager

```
100 POKE55,0:POKE56,25:CLR:SA=
    PEEK(56)*256        :rem 187
110 LN=5:D$="{5 DOWN}":S$="
    {8 SPACES}"         :rem 72
120 PRINT CHR$(142)"{CLR}"D$TA
    B(8)"{RVS} DICTIONARY MANA
    GER "               :rem 239
130 PRINT "{2 DOWN} PRESS: [1]
     TO REVIEW ENTRIES{DOWN}":
    PRINT S$"[2] TO ADD ENTRIE
    S{DOWN}"            :rem 218
140 PRINT S$"[3] TO EDIT ENTRI
    ES{DOWN}":PRINT S$"[4] TO
    {SPACE}PRINT ENTRIES{DOWN}
    "                   :rem 133
150 PRINT S$"[5] TO PREPARE A
    {SPACE}NEW DISK{DOWN}":PRI
    NT S$"[6] TO EXIT THE MANA
    GER{3 DOWN}"        :rem 64
160 GET K$:IF K$<"1" OR K$>"6"
     THEN160            :rem 93
170 PRINT"{CLR}{4 DOWN}":ON VA
    L(K$) GOSUB370,450,670,550
    ,190,180:GOTO120    :rem 185
180 PRINT"{CLR}":END    :rem 14
190 PRINT S$"{RVS} CREATE NEW
    {SPACE}DICTIONARY DISK ":P
    RINT"{2 DOWN}ARE YOU SURE"
    ;                   :rem 47
200 INPUT" [Y/N]";K$:IF LEFT$(
    K$,1)<>"Y" THEN PRINT"
    {CLR}":RETURN       :rem 151
```

```
210 INPUT"{2 DOWN}UNIQUE ID FO
    R THIS DISK";ID$:PRINT"
    {2 DOWN}FORMATTING....PLEA
    SE WAIT"              :rem 242
220 OPEN 15,8,15,"N0:DICTIONAR
    Y DISK,"+ID$:GOSUB910:IF E
    R THEN RETURN         :rem 54
230 PRINT"{DOWN}FORMATTING COM
    PLETE...CREATING HEADINGS:
    "                     :rem 31
240 FOR I=65 TO 90:OPEN 1,8,8,
    "0:"+CHR$(I)+",S,W":GOSUB9
    10:IF ER THEN270      :rem 108
250 CLOSE 1:PRINT CHR$(I);:NEX
    T:PRINT               :rem 27
260 PRINT"{DOWN}** DICTIONARY
    {SPACE}DISK CREATED **
    {2 DOWN}":GOTO880     :rem 112
270 PRINT"CREATING FILE FOR ";
    CHR$(I):PRINT"{DOWN}TRY AG
    AIN";:GOTO200         :rem 79
280 PRINT S$"{DOWN}(ENTER
    {RVS}@{OFF} FOR MENU)
    {DOWN}"               :rem 211
290 INPUT"{DOWN}STARTING WITH"
    ;L$:L=ASC(L$+CHR$(0)):IF L
    =64 OR L=42 THEN RETURN
                          :rem 54
300 L$=CHR$(L):IF L<65 OR L>90
     THEN PRINT S$L$" IS NOT A
    VALID LETTER":GOTO290
                          :rem 49
310 OPEN15,8,15:OPEN1,8,8,"0:"
    +L$+K$:GOSUB910:IF ER=0 TH
    EN RETURN             :rem 198
320 PRINT"{DOWN}TRYING TO ACCE
    SS FILE FOR ";L$:GOTO290
                          :rem 105
330 F=0:GET#1,K$:K=ASC(K$+CHR$
    (0)):IF K>127 THEN K=K AND
     127:F=1              :rem 161
340 IF K<>39 THEN K=K OR 64
                          :rem 100
350 W$=W$+CHR$(K):IF ST OR F T
    HEN RETURN            :rem 249
360 GOTO330               :rem 104
370 PRINT S$"{RVS} REVIEW ENTR
    IES ":K$=",S,R":GOSUB280:I
    F L=64 OR L=42 THEN RETURN
                          :rem 182
380 GET#1,K$:W$=L$:GOSUB330:IF
     MID$(W$,2,1)<>"@" THEN400
                          :rem 43
390 PRINT"{DOWN}** NO ENTRIES
    {SPACE}FOR ";L$;" **":GOTO
    880                   :rem 1
400 PRINT CHR$(14)"{CLR}
    {2 DOWN}ENTRIES FOR "L$:PR
    INT"{DOWN}(HOLD DOWN {RVS}
     SPACE {OFF} TO ADVANCE)
    {DOWN}"               :rem 196
410 PRINT S$;W$:IF ST THEN430
                          :rem 133
420 WAIT 203,64,64:W$=L$:GOSUB
    330:GOTO410           :rem 70
430 IF ST<>64 THEN910 :rem 122
440 WAIT 203,64:POKE 198,0:GOT
    O880                  :rem 114
450 PRINT S$"{RVS} ADD ENTRIES
     ":K$=",A":GOSUB280:IF L=6
    4 OR L=42 THEN RETURN
                          :rem 28
460 PRINT CHR$(14)"{CLR}{DOWN}
    ENTER WORDS STARTING WITH
    {SPACE}{RVS}";L$   :rem 184
465 PRINT"{DOWN}(TYPE {RVS}@
    {OFF} TO QUIT){DOWN}"
                          :rem 111
470 W$="":INPUT W$:F$=LEFT$(W$
    ,1):IF F$="@"THEN CLOSE1:C
    LOSE15:PRINT"{CLR}":RETURN
                          :rem 205
480 IF F$<>L$ AND F$<>CHR$(L+1
    28)THENPRINTW$" DOESN'T ST
    ART WITH "L$"{DOWN}":GOTO4
    70                    :rem 166
490 N=LEN(W$):IF N<LN THEN PRI
    NT W$" HAS FEWER THAN"LN"L
    ETTERS{DOWN}":GOTO470
                          :rem 219
500 FOR I=2 TO N:K=ASC(MID$(W$
    ,I)):IF K=39 THEN520
                          :rem 209
510 IF K<65 OR(K>90 AND K<193)
    OR K>218 THEN K=0     :rem 158
520 K=K AND 63:IF I=N THEN K=K
     OR 128               :rem 129
530 IF K THEN PRINT#1,CHR$(K);
    :IF ST THEN910        :rem 191
540 NEXT:PRINT S$W$" ADDED.":G
    OTO470                :rem 99
550 PRINT S$"{RVS}{2 SPACES}PR
    INT ENTRIES{2 SPACES}":PRI
    NT"{DOWN}{2 SPACES}(ENTER
    {SPACE}{RVS}*{OFF} TO PRIN
    T ALL ENTRIES)"       :rem 119
560 K$=",S,R":GOSUB280:IF L=64
     THEN RETURN          :rem 167
570 OPEN 4,4,7:IF L=42 THEN FO
    R I=65 TO 90:L$=CHR$(I):K$
    =",S,R":GOSUB310      :rem 135
580 GET#1,K$:W$=L$:GOSUB330:K=
    ST:IF MID$(W$,2,1)<>"@" TH
    EN600                 :rem 152
590 PRINT#4,"** NO ENTRIES FOR
     "L$" **":GOTO650     :rem 250
600 PRINT#4,"ENTRIES BEGINNING
     WITH "L$":":PRINT#4
                          :rem 93
610 FOR J=0 TO 3:PRINT#4,W$SPC
    (20-LEN(W$));:IF K THEN J=
    4:GOTO630             :rem 134
620 W$=L$:GOSUB330:K=ST
                          :rem 121
630 NEXT J:PRINT#4:IF K=0 THEN
    610                   :rem 135
640 IF K<>64 THEN CLOSE 4:GOTO
    910                   :rem 62
650 CLOSE 1:CLOSE 15:PRINT#4:P
    RINT#4:IF L=42 THEN NEXT I
                          :rem 3
660 CLOSE 4:RETURN        :rem 96
670 PRINT S$"{RVS} EDIT ENTRIE
    S ":K$=",S,R":GOSUB280:IF
    {SPACE}L=64 OR L=42 THEN R
    ETURN                 :rem 13
680 PRINT CHR$(14)"{CLR}
    {2 DOWN}EDIT WORDS STARTIN
    G WITH "L$":"         :rem 166
690 PRINT"{DOWN}(ENTER {RVS}@
    {OFF} TO CANCEL EDITING)
    {2 DOWN}":GET#1,K$:AD=SA
                          :rem 188
700 W$=L$:GOSUB330:IF MID$(W$,
    2,1)="@" THEN PRINT"** NO
    {SPACE}ENTRIES **":GOTO880
                          :rem 16
710 PRINT"{2 SPACES}"W$:K$="":
    INPUT"{UP}";K$:N=LEN(K$):I
    F N=0 THEN800         :rem 6
720 F$=LEFT$(K$,1):IF F$="@" T
    HEN PRINT"{DOWN}EDITING CA
    NCELED":GOTO880       :rem 119
730 IF F$<>L$ AND F$<>CHR$(L+1
    28)THEN PRINT K$" DOESN'T
    {SPACE}START WITH "L$:GOTO
    710                   :rem 64
740 IF N<LN THEN PRINT K$"HAS
    {SPACE}FEWER THAN"LN"LETTE
    RS":GOTO710           :rem 73
750 FOR I=2 TO N:K=ASC(MID$(K$
    ,I)):IF K=39 THEN780
                          :rem 212
760 IF(K>64 AND K<91)OR(K>192
    {SPACE}AND K<219) THEN780
                          :rem 15
770 PRINT K$" HAS INVALID CHAR
    ACTER":AD=AD-I-2:GOTO710
                          :rem 175
780 K=K AND 63:IF I=N THEN K=K
     OR 128               :rem 137
790 POKE AD,K:AD=AD+1:NEXT:IF
    {SPACE}AD>40959 THEN AD=AD
    -N:PRINT"{RVS}BUFFER FULL"
    :GOTO820              :rem 192
800 IF ST=0 THEN700       :rem 1
810 IF ST<>64 THEN910 :rem 124
820 PRINT"{2 DOWN}** WRITING N
    EW FILE FOR "L$" **"
                          :rem 126
830 CLOSE 1:PRINT#15,"S0:"+L$:
    GOSUB910:IF ER<2 THEN860
                          :rem 73
840 INPUT"TRY AGAIN [Y/N]";K$:
    IF LEFT$(K$,1)<>"Y" THEN R
    ETURN                 :rem 98
850 OPEN 15,8,15:GOTO820
                          :rem 56
860 OPEN 1,8,8,"0:"+L$+",S,W":
    PRINT#1:IF ST THEN GOSUB91
    0:GOTO840             :rem 146
870 FOR I=SA TO AD-1:PRINT#1,C
    HR$(PEEK(I));:NEXT:IF ST T
    HEN GOSUB910:GOTO840
                          :rem 250
880 CLOSE 1:CLOSE 15:PRINT"
    {DOWN}{RVS} PRESS ANY KEY
    {SPACE}FOR MENU "     :rem 5
890 GET K$:IF K$="" THEN890
                          :rem 121
900 PRINT"{CLR}":RETURN:rem 23
910 INPUT#15,ER,E$:IF ER>1 THE
    N PRINT"{DOWN}{RVS} DISK E
    RROR:";ER;E$:CLOSE 15:CLOS
    E 1                   :rem 89
920 RETURN                :rem 123
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Program 2: SpeedCheck

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49152 :029,008,010,000,153,034,234
49158 :147,014,008,034,058,158,169
49164 :050,048,056,050,058,083,101
49170 :080,069,069,068,067,072,187
49176 :069,067,075,000,000,000,235
49182 :015,012,001,169,005,009,241
49188 :176,141,020,018,173,031,083
49194 :008,141,033,208,141,032,093
49200 :208,165,001,041,254,133,082
49206 :001,169,000,133,254,032,131
49212 :144,255,169,203,205,110,122
49218 :035,141,110,035,208,027,110
49224 :133,254,173,008,032,133,037
49230 :176,173,009,032,133,177,010
49236 :024,173,023,032,105,001,186
49242 :133,174,173,024,032,105,219
49248 :000,133,175,032,117,011,052
49254 :162,000,160,000,032,154,098
49260 :011,032,032,011,173,032,143
49266 :008,166,254,240,003,173,190
49272 :033,008,141,040,216,032,078
49278 :162,008,165,254,240,009,196
49284 :224,013,208,005,032,189,035
49290 :016,208,011,224,136,208,173
49296 :236,032,067,016,165,248,140
49302 :240,203,032,162,008,032,059
49308 :200,008,076,153,008,164,253
49314 :166,177,168,072,177,168,066
49320 :073,128,145,168,169,226,053
49326 :133,255,032,228,255,164,217
49332 :166,170,208,009,202,208,119
49338 :253,198,255,208,241,240,045
49344 :229,104,145,168,096,162,072
49350 :013,032,102,009,032,144,018
49356 :009,138,176,057,201,013,030
49362 :208,003,076,236,012,201,178
49368 :017,208,003,076,219,009,236
49374 :201,029,208,003,076,180,151
49380 :009,201,094,208,003,076,051
49386 :232,010,201,133,208,025,019
49392 :032,180,009,176,111,032,012
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49398 :228,255,201,013,240,104,007
49404 :164,166,177,170,041,015,217
49410 :205,033,008,208,233,240,161
49416 :188,201,019,208,016,165,037
49422 :167,201,001,208,007,165,251
49428 :166,208,003,076,254,010,225
49434 :076,032,011,201,136,208,178
49440 :003,076,067,016,201,137,020
49446 :208,025,032,036,010,164,001
49452 :166,177,170,041,015,205,050
49458 :033,008,240,143,165,167,038
49464 :201,002,176,236,192,000,095
49470 :208,232,096,201,140,208,123
49476 :003,076,239,015,201,145,235
49482 :208,003,076,006,010,201,066
49488 :147,208,003,076,070,011,083
49494 :201,157,208,003,076,036,255
49500 :010,201,222,208,003,076,044
49506 :166,010,096,160,000,132,150
49512 :253,132,254,177,251,240,131
49518 :030,201,039,208,004,192,016
49524 :000,208,012,201,027,144,196
49530 :008,201,065,144,014,201,243
49536 :091,176,010,153,111,018,175
49542 :200,132,253,192,032,144,063
49548 :222,024,096,165,252,197,072
49554 :175,144,004,165,251,197,058
49560 :174,096,032,144,009,176,015
49566 :019,165,253,208,002,230,011
49572 :253,024,165,251,101,253,187
49578 :133,251,165,252,105,000,052
49584 :133,252,096,032,155,009,085
49590 :176,033,165,166,101,253,052
49596 :133,166,201,040,176,010,146
49602 :168,177,170,041,015,205,202
49608 :031,008,208,006,169,000,110
49614 :133,166,240,008,032,102,119
49620 :009,165,253,240,218,096,169
49626 :166,167,232,138,032,056,241
49632 :011,032,144,009,176,243,071
49638 :134,167,224,025,144,006,162
49644 :032,209,014,076,102,009,166
49650 :165,168,105,040,133,168,253
49656 :133,170,165,169,105,000,222
49662 :032,068,010,208,054,240,098
49668 :213,165,167,201,002,176,160
49674 :003,076,032,011,198,167,241
49680 :165,168,233,040,133,168,155
49686 :133,170,165,169,233,000,124
49692 :032,068,010,208,024,240,098
49698 :226,164,166,208,007,165,202
49704 :167,201,002,176,006,096,176
49710 :032,117,010,208,006,169,076
49716 :039,133,166,208,204,132,166
49722 :166,132,253,032,054,011,194
49728 :076,166,009,133,169,041,146
49734 :003,009,216,133,171,164,254
49740 :166,177,170,041,015,205,082
49746 :031,008,208,003,136,016,228
49752 :244,177,168,201,032,208,094
49758 :032,192,039,176,017,177,215
49764 :170,041,015,205,031,008,058
49770 :240,008,200,177,168,201,076
49776 :032,240,236,096,136,177,005
49782 :168,201,032,208,004,192,155
49788 :000,208,245,192,000,240,241
49794 :008,136,177,168,201,032,084
49800 :208,245,200,177,168,201,055
49806 :032,096,032,117,011,162,080
49812 :000,189,111,018,009,128,091
49818 :153,000,004,200,232,228,203
49824 :248,144,242,200,096,032,098
49830 :032,011,160,000,177,170,204
49836 :041,015,205,031,008,240,200
49842 :032,205,033,008,208,022,174
49848 :032,058,010,169,160,141,242
49854 :000,004,032,102,009,132,213
49860 :248,032,159,015,024,165,071
49866 :166,101,253,168,200,192,002
49872 :040,144,215,230,167,165,145
49878 :167,201,025,176,012,165,192
49884 :170,105,040,133,170,144,214
49890 :197,230,171,208,193,169,114
49896 :025,032,056,011,032,144,020
49902 :009,176,040,165,251,141,252
49908 :066,003,165,252,141,067,170
49914 :003,208,010,165,176,141,185
49920 :066,003,165,177,141,067,107
49926 :003,169,147,032,210,255,054
49932 :162,085,032,151,011,032,229
49938 :032,011,032,059,014,144,054
49944 :251,032,032,011,076,117,031
49950 :011,169,040,133,168,133,172
49956 :170,169,004,133,169,169,082
49962 :216,133,171,169,000,133,096
49968 :166,169,001,133,167,165,081
49974 :167,010,168,185,064,003,139
49980 :133,251,200,185,064,003,128
49986 :133,252,096,162,204,032,177
49992 :151,011,032,170,011,201,136
49998 :089,208,035,165,176,141,124
50004 :008,032,165,177,141,009,104
50010 :032,056,165,174,233,001,239
50016 :141,023,032,165,175,233,097
50022 :000,141,024,032,169,015,227
50028 :032;195,255,104,104,108,138
50034 :022,003,160,039,169,160,155
50040 :153,000,004,173,032,008,234
50046 :153,000,216,136,016,242,121
50052 :169,250,141,000,004,169,097
50058 :186,141,001,004,160,003,121
50064 :096,032,151,015,162,101,189
50070 :032,117,011,189,103,017,107
50076 :208,001,096,153,000,004,106
50082 :232,200,208,243,032,154,207
50088 :011,032,228,255,201,000,127
50094 :240,249,096,162,016,169,082
50100 :000,133,248,133,254,240,164
50106 :007,032,145,010,162,032,062
50112 :160,003,134,247,132,249,093
50118 :169,004,133,250,160,000,146
50124 :177,249,072,041,127,145,247
50130 :249,132,165,032,170,011,201
50136 :133,255,165,254,016,005,020
50142 :032,145,010,132,254,164,191
50148 :165,104,145,249,165,255,031
50154 :166,254,201,013,208,001,053
50160 :096,201,157,208,005,136,019
50166 :048,210,016,210,201,020,183
50172 :240,071,196,247,176,202,104
50178 :201,192,144,004,201,224,200
50184 :144,037,201,029,208,007,122
50190 :196,248,176,186,200,144,140
50196 :183,201,032,144,179,201,192
50202 :064,144,016,201,096,144,179
50208 :010,201,148,240,067,224,154
50214 :000,240,163,208,105,041,027
50220 :191,009,128,145,249,041,039
50226 :127,224,000,208,002,165,008
50232 :255,153,111,018,200,196,221
50238 :248,144,139,132,248,176,125
50244 :135,192,000,240,028,132,027
50250 :255,177,249,190,111,018,050
50256 :136,145,249,138,153,111,244
50262 :018,164,255,196,248,176,119
50268 :003,200,144,233,198,248,094
50274 :164,165,136,076,205,011,087
50280 :165,248,197,247,176,035,148
50286 :168,132,255,177,249,190,001
50292 :111,018,200,145,249,138,209
50298 :153,111,018,164,255,196,251
50304 :165,240,003,136,016,233,153
50310 :169,160,145,249,169,032,034
50316 :153,111,018,230,248,076,208
50322 :205,011,201,134,240,020,189
50328 :201,140,176,245,201,135,226
50334 :208,001,096,201,138,144,178
50340 :236,240,005,104,104,076,161
50346 :117,011,164,248,204,035,181
50352 :008,176,014,032,149,011,054
50358 :162,154,032,167,011,032,228
50364 :145,010,076,203,011,162,027
50370 :160,142,000,004,201,138,071
50376 :240,006,032,159,015,076,216
50382 :203,011,169,000,133,254,208
50388 :032,042,015,169,250,141,093
50394 :000,004,165,254,240,006,119
50400 :173,033,008,141,000,216,027
50406 :230,254,076,203,011,165,145
50412 :253,208,001,096,032,182,240
50418 :011,056,165,253,229,248,180
50424 :240,005,176,036,076,171,184
50430 :013,162,000,024,138,168,247
50436 :101,166,133,255,189,111,191
50442 :018,145,251,164,255,145,220
50448 :168,173,032,008,145,170,200
50454 :232,228,248,144,231,134,215
50460 :253,076,117,011,133,255,105
50466 :165,248,208,002,230,255,118
50472 :165,174,229,255,133,174,146
50478 :165,175,233,000,133,175,159
50484 :165,252,133,250,166,251,245
50490 :165,248,208,007,202,224,088
50496 :255,208,002,198,250,134,087
50502 :249,164,255,177,249,160,044
50508 :000,145,249,166,249,232,093
50514 :208,002,230,250,228,174,150
50520 :208,235,165,250,197,175,038
50526 :208,229,166,167,232,138,210
50532 :010,168,056,185,064,003,074
50538 :229,255,153,064,003,200,242
50544 :185,064,003,233,000,153,238
50550 :064,003,224,025,144,230,040
50556 :024,165,166,133,165,101,110
50562 :255,168,132,255,177,168,005
50568 :072,177,170,164,165,145,005
50574 :170,104,145,168,230,165,100
50580 :164,255,200,192,040,144,119
50586 :233,164,165,032,192,014,186
50592 :165,248,240,003,076,000,124
50598 :013,076,117,011,073,255,199
50604 :133,255,230,255,165,174,104
50610 :133,249,101,255,133,174,199
50616 :165,175,133,250,105,000,244
50622 :133,175,160,000,177,249,060
50628 :164,255,145,249,166,249,144
50634 :208,002,198,250,202,134,172
50640 :249,228,251,208,235,165,008
50646 :250,197,252,208,229,166,236
50652 :167,232,138,010,168,024,191
50658 :185,064,003,101,255,153,219
50664 :064,003,200,185,064,003,239
50670 :105,000,153,064,003,224,019
50676 :025,144,230,032,000,013,176
50682 :162,006,181,165,157,059,212
50688 :003,202,208,248,134,166,193
50694 :166,167,232,138,032,056,029
50700 :011,133,250,165,251,133,187
50706 :249,032,054,011,032,059,199
50712 :014,176,012,165,251,197,071
50718 :249,208,229,165,252,197,050
50724 :250,208,223,162,006,189,050
50730 :059,003,149,165,202,208,060
50736 :248,168,076,058,010,032,128
50742 :155,009,176,057,032,102,073
50748 :009,170,192,000,240,032,191
50754 :024,152,101,166,201,040,238
50760 :176,041,204,035,008,144,168
50766 :003,032,042,015,160,000,074
50772 :132,255,032,169,014,164,082
50778 :255,200,196,253,144,244,102
50784 :176,211,032,173,014,165,099
50790 :166,201,040,176,005,138,060
50796 :201,031,208,197,032,155,164
50802 :009,164,166,032,192,014,179
50808 :169,000,133,166,230,167,217
50814 :165,167,010;168,165,251,028
50820 :153,064,003,200,165,252,201
50826 :153,064,003,032,144,009,031
50832 :176,021,165,167,201,025,131
50838 :176,015,165,168,105,040,051
50844 :133,168,133,170,144,005,141
50850 :230,169,230,171,024,096,058
50856 :177,251,005,254,164,166,161
50862 :145,168,173,032,008,005,193
50868 :254,016,003,173,033,008,155
50874 :145,170,230,166,096,192,161
50880 :040,144,001,096,169,032,162
50886 :145,168,173,031,008,145,100
50892 :170,200,208,239,032,032,061
50898 :011,162,001,024,165,168,229
50904 :133,247,133,249,105,040,099
50910 :133,168,133,170,165,169,136
50916 :133,248,165,171,133,250,048
50922 :144,004,230,169,230,171,158
50928 :160,039,177,168,145,247,152
50934 :177,170,145,249,136,016,115
50940 :245,232,224,024,144,211,052
50946 :162,001,138,010,168,185,154
50952 :066,003,153,064,003,200,241
50958 :185,066,003,153,064,003,232
50964 :232,224,025,144,235,160,016
50970 :000,032,192,014,032,037,077
50976 :015,032,059,014,169,024,089
50982 :076,052,011,136,132,255,188
50988 :173,111,018,009,064,141,048
50994 :094,018,169,001,162,008,246
51000 :160,008,032,186,255,169,098
51006 :007,162,092,160,018,032,021
51012 :189,255,032,192,255,162,129
51018 :001,032,198,255,032,207,031
51024 :255,160,000,165,144,208,244
51030 :049,032,207,255,200,196,001
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51036 :255,144,006,201,128,144,202
51042 :024,041,127,201,128,176,027
51048 :232,141,115,015,185,111,135
51054 :018,041,063,201,000,208,129
51060 :006,196,255,144,218,240,151
51066 :027,165,144,208,009,032,195
51072 :207,255,201,128,176,203,018
51078 :144,243,201,064,240,006,008
51084 :032,059,017,076,117,011,196
51090 :169,128,133,254,169,001,232
51096 :032,195,255,076,204,255,145
51102 :136,132,255,173,111,018,215
51108 :009,064,141,101,018,169,154
51114 :001,162,008,160,008,032,029
51120 :186,255,169,005,162,099,028
51126 :160,018,032,189,255,032,100
51132 :192,255,162,001,032,201,007
51138 :255,160,000,200,185,111,081
51144 :018,041,063,196,255,144,149
51150 :002,009,128,032,210,255,074
51156 :196,255,144,237,032,059,111
51162 :017,240,003,076,145,010,197
51168 :032,151,015,032,145,010,097
51174 :162,230,134,254,032,154,172
51180 :011,096,162,078,032,151,254
51186 :011,162,048,032,167,011,161
51192 :201,013,208,067,162,183,058
51198 :032,151,011,162,192,032,066
51204 :154,011,032,178,011,165,043
51210 :248,240,050,032,026,017,111
51216 :208,234,169,001,162,008,030
51222 :160,001,032,186,255,024,168
51228 :169,002,101,248,162,109,051
51234 :160,018,032,189,255,169,089
51240 :176,166,174,164,175,032,159
51246 :216,255,144,005,032,059,245
51252 :017,208,197,032,145,010,149
51258 :162,237,032,167,011,076,231
51264 :117,011,162,188,032,151,213
51270 :011,032,178,011,165,248,203
51276 :240,241,032,026,017,208,072
51282 :239,169,001,162,008,160,053
51288 :008,032,186,255,162,000,219
51294 :164,248,189,104,018,153,202
51300 :111,018,200,232,224,004,121
51306 :144,244,200,200,152,162,184
51312 :109,160,018,032,189,255,107
51318 :032,192,255,162,001,032,024
51324 :198,255,032,207,255,133,180
51330 :176,133,174,165,144,208,106
51336 :043,032,207,255,133,177,215
51342 :133,175,201,032,144,019,078
51348 :160,000,165,144,208,022,079
51354 :032,207,255,145,174,230,173
51360 :174,208,243,230,175,208,118
51366 :239,032,146,011,232,032,090
51372 :167,011,208,146,201,064,201
51378 :240,005,032,059,017,208,227
51384 :137,032,151,015,162,042,211
51390 :032,151,011,032,228,255,131
51396 :201,013,208,249,032,026,157
51402 :017,208,239,169,001,162,230
51408 :008,160,008,032,186,255,089
51414 :169,002,162,091,160,018,048
51420 :032,189,255,032,192,255,151
51426 :162,001,032,198,255,160,010
51432 :142,032,207,255,136,208,188
51438 :250,165,144,240,005,032,050
51444 :059,017,208,196,032,207,195
51450 :255,041,063,009,128,217,195
51456 :152,017,208,011,200,192,012
51462 :015,144,239,032,151,015,090
51468 :076,254,010,032,146,011,029
51474 :162,134,032,167,011,208,220
51480 :163,169,015,032,195,255,085
51486 :032,204,255,169,160,141,223
51492 :000,004,169,015,168,162,042
51498 :008,032,186,255,169,003,183
51504 :162,108,160,018,032,189,205
51510 :255,032,192,255,032,204,000
51516 :255,162,015,032,198,255,209
51522 :032,207,255,133,255,201,125
51528 :048,208,003,076,204,255,098
51534 :032,149,011,165,255,009,187
51540 :128,153,000,004,200,032,089
51546 :207,255,201,013,208,243,193
51552 :032,151,015,076,170,011,039
51558 :211,144,133,133,132,250,081
51564 :186,160,211,144,133,140,058
51570 :140,137,142,135,160,195,255
51576 :136,133,131,139,133,146,170
51582 :160,134,143,146,160,211,056
51588 :144,133,133,132,211,131,248
51594 :146,137,144,148,032,000,233
51600 :201,142,147,133,146,148,037
51606 :160,132,137,131,148,137,227
51612 :143,142,129,146,153,160,005
51618 :132,137,147,139,160,166,019
51624 :160,136,137,148,160,210,095
51630 :197,212,213,210,206,000,188
51636 :210,133,141,143,150,133,066
51642 :000,208,140,133,129,147,175
51648 :133,160,151,129,137,148,026
51654 :160,174,174,174,000,197,053
51660 :146,146,143,146,186,160,107
51666 :000,201,142,150,129,140,204
51672 :137,132,160,147,148,129,045
51678 :146,148,137,142,135,160,066
51684 :129,132,132,146,133,147,023
51690 :147,000,201,142,131,143,230
51696 :146,146,133,131,148,160,080
51702 :132,137,147,139,160,142,079
51708 :129,141,133,000,205,149,241
51714 :147,148,160,136,129,150,104
51720 :133,160,129,148,160,140,110
51726 :133,129,147,148,160,128,091
51732 :160,140,133,148,148,133,114
51738 :146,147,000,211,129,150,041
51744 :133,000,204,143,129,132,005
51750 :160,134,137,140,133,142,116
51756 :129,141,133,186,160,000,025
51762 :197,152,137,148,186,160,006
51768 :129,146,133,160,153,143,152
51774 :149,160,147,149,146,133,178
51780 :160,155,217,175,206,157,114
51786 :191,000,129,132,132,133,023
51792 :132,174,000,147,129,150,044
51798 :133,132,174,000,036,048,097
51804 :058,000,044,083,044,082,147
51810 :048,058,000,044,065,044,101
51816 :080,044,082,073,048,058,233
```

All Commodore 64 programs in this issue work with the Commodore 128 in 64 mode.

MLX: 64 Version

Article on page 142.

```
10 REM LINES CHANGED FROM MLX
   {SPACE}VERSION 2.00 ARE 750
   ,765,770 AND 860      :rem 50
20 REM LINE CHANGED FROM MLX V
   ERSION 2.01 IS 300 :rem 147
100 PRINT"{CLR}{63}";CHR$(142);
    CHR$(8);:POKE53281,1:POKE5
    3280,1                :rem 67
101 POKE 788,52:REM DISABLE RU
    N/STOP                :rem 119
110 PRINT"{RVS}{39 SPACES}";
                          :rem 176
120 PRINT"{RVS}{14 SPACES}
    {RIGHT}{OFF}{*}£{RVS}
    {RIGHT} {RIGHT}{2 SPACES}
    {*}{OFF}{*}£{RVS}£{RVS}
    {14 SPACES}";         :rem 250
130 PRINT"{RVS}{14 SPACES}
    {RIGHT} {G}{RIGHT}
    {2 RIGHT} {OFF}£{RVS}£
    {*}{OFF}{*}{RVS}
    {14 SPACES}";         :rem 35
140 PRINT"{RVS}{41 SPACES}"
                          :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK} M
    ACHINE LANGUAGE EDITOR VER
    SION 2.02{5 DOWN}":rem 238
210 PRINT"{5}{2 UP}STARTING AD
    DRESS?{8 SPACES}{9 LEFT}";
                          :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+11
    9*F)                  :rem 166
220 IFS<256OR(S>40960ANDS<4915
    2)ORS>53247THENGOSUB3000:G
    OTO210                :rem 235
225 PRINT:PRINT:PRINT :rem 180
230 PRINT"{5}{2 UP}ENDING ADDR
    ESS?{8 SPACES}{9 LEFT}";:I
    NPUTE:F=1-F:C$=CHR$(31+119
    *F)                   :rem 20
240 IFE<256OR(E>40960ANDE<4915
    2)ORE>53247THENGOSUB3000:G
    OTO230                :rem 183
250 IFE<STHENPRINTC$;"{RVS}END
    ING < START{2 SPACES}":GOS
    UB1000:GOTO 230       :rem 176
260 PRINT:PRINT:PRINT :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S
                          :rem 56
310 A=1:PRINTRIGHT$("0000"+MID
    $(STR$(AD),2),5);":";
                          :rem 33
315 FORJ=ATO6             :rem 33
320 GOSUB570:IFN=-1THENJ=J+N:G
    OTO320                :rem 228
390 IFN=-211THEN 710      :rem 62
400 IFN=-204THEN 790      :rem 64
410 IFN=-206THENPRINT:INPUT"
    {DOWN}ENTER NEW ADDRESS";Z
    Z                     :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETH
    ENPRINT"{RVS}OUT OF RANGE"
    :GOSUB1000:GOTO410:rem 225
417 IFN=-206THENAD=ZZ:PRINT:GO
    TO310                 :rem 238
420 IF N<>-196 THEN 480
                          :rem 133
430 PRINT:INPUT"DISPLAY:FROM";
    F:PRINT,"TO";:INPUTT
                          :rem 234
440 IFF<SORF>EORT<SORT>ETHENPR
    INT"AT LEAST";S;"{LEFT}, N
    OT MORE THAN";E:GOTO430
                          :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINT
    RIGHT$("0000"+MID$(STR$(I)
    ,2),5);":";           :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRIN
    TRIGHT$("00"+MID$(STR$(N),
    2),3);",";            :rem 66
460 GETA$:IFA$>""THENPRINT:PRI
    NT:GOTO310            :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI
    :PRINT:PRINT:GOTO310
                          :rem 50
480 IFN<0 THEN PRINT:GOTO310
                          :rem 168
490 A(J)=N:NEXTJ          :rem 199
500 CKSUM=AD-INT(AD/256)*256:F
    ORI=1TO6:CKSUM=(CKSUM+A(I)
    )AND255:NEXT          :rem 200
510 PRINTCHR$(18);:GOSUB570:PR
    INTCHR$(146);         :rem 94
511 IFN=-1THENA=6:GOTO315
                          :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHE
    N530                  :rem 122
520 PRINT:PRINT"LINE ENTERED W
    RONG : RE-ENTER":PRINT:GOS
    UB1000:GOTO310        :rem 176
530 GOSUB2000             :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):
    NEXT:POKE54272,0:POKE54273
    ,0                    :rem 227
550 AD=AD+6:IF AD<E THEN 310
                          :rem 212
560 GOTO 710              :rem 108
570 N=0:Z=0               :rem 88
580 PRINT"{£}";           :rem 81
581 GETA$:IFA$=""THEN581
                          :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*
    (A$=".")-4*(A$="J")-5*(A$=
    "K")-6*(A$="L")       :rem 41
583 AV=AV-7*(A$="U")-8*(A$="I"
    )-9*(A$="O"):IFA$="H"THENA
```

```
    $="0"                    :rem 134
584 IFAV>0THENA$=CHR$(48+AV)
                             :rem 134
585 PRINTCHR$(20);:A=ASC(A$):I
    FA=13ORA=44ORA=32THEN670
                             :rem 229
590 IFA>128THENN=-A:RETURN
                             :rem 137
600 IFA<>20 THEN 630         :rem 10
610 GOSUB690:IFI=1ANDT=44THENN
    =-1:PRINT"{OFF}{LEFT}
    {LEFT}";:GOTO690         :rem 62
620 GOTO570                  :rem 109
630 IFA<48ORA>57THEN580
                             :rem 105
640 PRINTA$;:N=N*10+A-48
                             :rem 106
650 IFN>255 THEN A=20:GOSUB100
    0:GOTO600                :rem 229
660 Z=Z+1:IFZ<3THEN580       :rem 71
670 IFZ=0THENGOSUB1000:GOTO570
                             :rem 114
680 PRINT",";:RETURN         :rem 240
690 S%=PEEK(209)+256*PEEK(210)
    +PEEK(211)               :rem 149
691 FORI=1TO3:T=PEEK(S%-I)
                             :rem 67
695 IFT<>44ANDT<>58THENPOKES%-
    I,32:NEXT                :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1)
    ;:RETURN                 :rem 7
710 PRINT"{CLR}{RVS}*** SAVE *
    **{3 DOWN}"              :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}
    RETURN{OFF} ALONE TO CANCE
    L SAVE){DOWN}"           :rem 106
720 F$="":INPUT"{DOWN} FILENAM
    E";F$:IFF$=""THENPRINT:PRI
    NT:GOTO310               :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"                 :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN740                   :rem 36
750 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$:OPEN15,8,15,"S"
    +F$:CLOSE15              :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                        :rem 3
762 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                             :rem 109
763 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466            :rem 69
765 K=S:POKE254,K/256:POKE253,
    K-PEEK(254)*256:POKE780,25
    3                        :rem 17
766 K=E+1:POKE782,K/256:POKE78
    1,K-PEEK(782)*256:SYS65496
                             :rem 235
770 IF(PEEK(783)AND1)OR(191AND
    ST)THEN780               :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":G
    OTO310                   :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.
    {2 SPACES}TRY AGAIN.":IFDV
    =1THEN720                :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO720                    :rem 103
790 PRINT"{CLR}{RVS}*** LOAD *
    **{2 DOWN}"              :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}
    RETURN{OFF} ALONE TO CANCE
    L LOAD)"                 :rem 82
800 F$="":INPUT"{2 DOWN} FILEN
    AME";F$:IFF$=""THENPRINT:G
    OTO310                   :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"                 :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN820                   :rem 34
830 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$               :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                        :rem 2
841 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                             :rem 107
845 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466            :rem 70
850 POKE780,0:SYS65493       :rem 11
860 IF(PEEK(783)AND1)OR(191AND
    ST)THEN870               :rem 111
865 PRINT"{DOWN}DONE.":GOTO310
                             :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.
    {2 SPACES}TRY AGAIN.{DOWN}
    ":IFDV=1THEN800          :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO800                    :rem 102
1000 REM BUZZER              :rem 135
1001 POKE54296,15:POKE54277,45
     :POKE54278,165          :rem 207
1002 POKE54276,33:POKE 54273,6
     :POKE54272,5            :rem 42
1003 FORT=1TO200:NEXT:POKE5427
     6,32:POKE54273,0:POKE5427
     2,0:RETURN              :rem 202
2000 REM BELL SOUND          :rem 78
2001 POKE54296,15:POKE54277,0:
     POKE54278,247           :rem 152
2002 POKE 54276,17:POKE54273,4
     0:POKE54272,0           :rem 86
2003 FORT=1TO100:NEXT:POKE5427
     6,16:RETURN             :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PA
     GE OR ROM":GOTO1000
                             :rem 89
```


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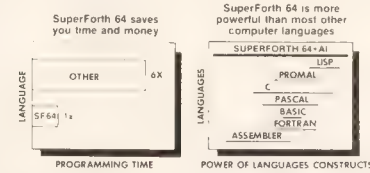

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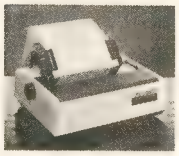

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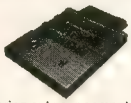

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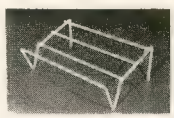

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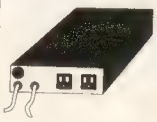

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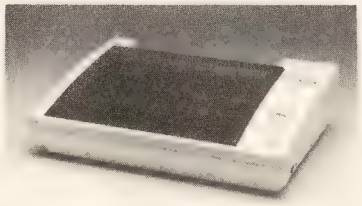

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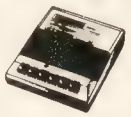

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NEW NEW

VIZASTAR for the C128

Vizastar, the integrated spreadsheet, database and graphics program that has the Commodore 64 world raving, is now available for the C128. It boasts 80 columns, and has over 40K of free memory in the spreadsheet. Those who already own Vizastar 64 will be pleased to know that your existing files can be read by Vizastar 128. Also, you can upgrade to the 128 version. Call us for details and pricing.

"The only other comparable product would be Lotus 1-2-3 for the IBM PC; nothing in the C64 world comes even close to the features of Vizastar."

AHOY July 85

"I found Vizastar would do anything Lotus 1-2-3 could, and then some. It's my Commodore choice to become the standard against which the others will be judged."

INFO 64 Magazine, Issue #7

"Vizastar is an exceptional package that rivals the features of programs such as Lotus 1-2-3 and offers C64 owners the kind of integrated software previously only available for higher-priced systems."

RUN Magazine, June 1985

"I scrutinized, tested and experimented with Vizastar extensively, but could find no weaknesses whatsoever. It is the most comprehensive, most flexible, most powerful and easiest to use integrated software package I've worked with."

Commodore Microcomputer, Sept/Oct 1985

"I use an IBM PC at work with Lotus 123. I feel Vizastar is just as good and in someways better than 1-2-3."

Steven Roberson, NC. End User

"I have used Multiplan and Superbase; both are good pieces of software, but are inadequate when compared to Vizastar."

Jim Mathews, WA. End User

"So good, I bought a second C64 and Vizastar for my office. A wild bargain! You've saved me from having to buy IBM and Lotus."

Philip Ressler, MA. End User

VIZAWRITE CLASSIC for C128

This is the new word processor from Vizastar's author, Kevin Lacy and is the successor to Omniwriter, which he also wrote. All the features of Omniwriter are there, plus many significant enhancements, like auto pagination, on-line help, pull-down menus, full-function calculator and more. Up to 8 'newspaper-style' variable-width columns can help with newsletters.

Three different proportionally-spaced "near letter quality" fonts are also built-in for use with Commodore or Epson compatible printers. You can merge almost any other word processor file directly into Vizawrite, including Paper Clip and Omniwriter. Naturally, it is also compatible with Vizastar. At all times, what you see on the screen is exactly the way it will be printed out. Vizawrite can do mail-merges and has an integrated 30,000 word spelling checker that you can expand yourself.

PROGRAM SPECIFICATIONS

Both Vizawrite and Vizastar are written in 100% machine language and run in the 128's FAST mode, making it lightning fast. They require a C128 with 80 column color or monochrome monitor. Both come with a cartridge, a diskette, a backup, and a reference manual. Vizastar also includes a 50 page tutorial book. Both work with 1541 or 1571 disk drives.

RISK-FREE OFFER

Vizastar 128 is priced at $119.97. Vizawrite's price is $79.97, but as an introductory offer, it is now only $69.97. Vizastar 64 XL8 is now available for $119.97. We are so positive you will be satisfied with our programs that we offer a 15-day money-back guarantee. Try it Risk-Free. Call us today or send a check or money order. VISA/MC accepted.

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—PC MAGAZINE

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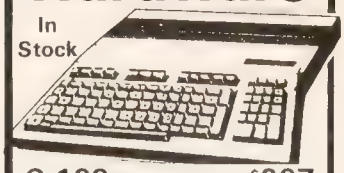

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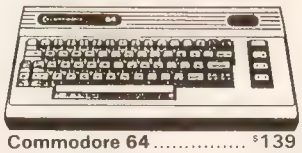

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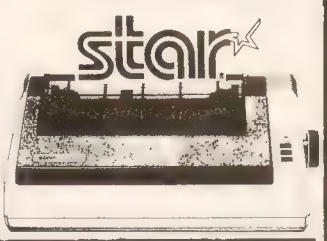

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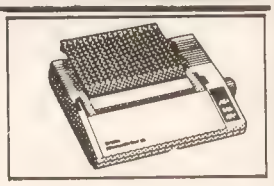

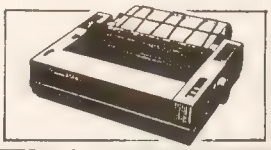

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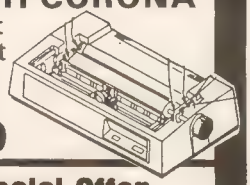

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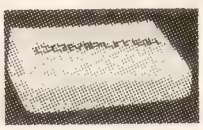

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The Melodian Musical Keyboard for the Commodore 64 and 128.

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At last, a program that makes it not only easy but fun to learn music. The Melodian keyboard and software were designed by Harry Mendell who designs custom synthesizer electronics and software for professional musicians such as **Stevie Wonder** and Eric Himy, an award winning concert pianist. The Melodian boasts many of the professional features found only on more expensive equipment. These features include multitrack recording, the ability to create custom instrument sounds and most importantly, ease of use.

Start your lesson with **RhythmMaster** Software. With its built-in metronome, RhythmMaster will display the treble and bass musical staffs and a picture of a piano keyboard. RhythmMaster will then play a measure of music and you must try to play the same measure back on the Melodian keyboard. You're not familiar with the keyboard or can't read music? No problem. RhythmMaster displays the notes you are to play on the musical staff and on the keyboard pictured on the monitor. If you strike the wrong key the note on the musical staff turns red and shows you which key you played wrong, making it ever so easy to correct what you played.

If you should hold a key too long a turtle runs across the screen. Inversely if you should release a key too quickly a rabbit scurries by. If you don't play it correctly RhythmMaster knows it and repeats the measure for you to play.

Sounds easy doesn't it? Now add the fun. You start with six composers (Bach, Handel, Mozart, Beethoven, Schubert and Wagner). The object is to attain the next level of difficulty without losing a composer. You lose a composer each time you accumulate ten mistakes. There are twelve levels of difficulty attainable ranging from tyro to maestro.

ConcertMaster teaches you how to play 35 pre-recorded songs from Bach to Rock. With ConcertMaster you can analyze music note by note, instrument by instrument and learn how a music composition is put together. Then you can compose your own music and record it right onto your floppy disks.

There are nineteen different instrument sounds to choose from in over a seven octave range giving you a wide choice of instruments to suit your musical taste and expression. You can also create your own instrument sounds.

ScoreMaster enables you to print out your music in standard music notation for other musicians to play, or for yourself.

AHOY! Magazine Says . . .

Peggy Herrington of AHOY! said "The system is so easy to use that I didn't need the documation". "It's fun, challenging, and educational, and for playability and ease of use it is nothing short of spectacular."

New York Times Says . . .

Erik Sandberg-Diment of the New York Times states "really useful and instructive item ... Tanya, our 10 year old beginner quickly caught the spirit of matching the dance of her fingers to the measured metronome." "One piece of educational software that, unlike most of its kinfolk, actually delivers. These software-hardware combinations offer a lot of entertainment to the Commodore owner."

RUN Magazine Says . . .

Tom Benford of RUN notes "Whenever a selection of products of the same genre is available, one among the bunch rises head and shoulders above the rest. Such is the case with Melodian ConcertMaster keyboard and software. The combined features of RhythmMaster and ConcertMaster give you a complete music tutorial."

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Melodian Musical Keyboard
kb-01

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Keyboard
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Registers (with ConcertMaster)
Organ, Trumpet, Flute, Clarinet, Piano, Harpsicord, Violin, Cello, Bass, Banjo, Mandolin, Calliope, Concertino, Bagpipe, Synthesizer 1, Synthesizer 2, Clavier 1, Clavier 2, which can be played over a 7 octave range. Programmable sounds as well.

Recording (with ConcertMaster)
Three track sequencer (recorder) with overdubbing and multitimbral (different instrument sounds at the same time) effects.

Interface
Built in interface for Commodore 64, Commodore 128, plugs right in to joystick port no. 2 and user port.

Power Supply
Powered direct by the computer, no batteries and cords required.

Finish
Table Model in white high-impact material, with carrying handle, protective key cover, and built in music stand. Size 29 -1/8 X 9-9/16 X 3-11/16, weighs 9 pounds.

Melodian ScoreMaster
sm-01

$29.95

With the ScoreMaster program your music can be printed out in music notation, which other musicians can read and play. Any music recorded with the ConcertMaster program can be printed by ScoreMaster.

ScoreMaster Requires:
- Commodore 64 or Commodore 128 with disk drive and printer compatible with the Commodore graphics mode such as the Commodore MPS 803, 1515, and 1525.
- Melodian ConcertMaster program.

RhythmMaster Software
rm-01

$29.95

RhythmMaster teaches a beginner how to read music and play it correctly and in rhythm on the musical keyboard.

RhythmMaster will have you reading and playing musical notes in minutes with fun and excitement.

RhythmMaster Features:
- Trumpet, organ, violin, and synthesizer instrument sounds.
- Built in metronome.
- Pause/Play control.
- Set-up menu for customizing RhythmMaster.

RhythmMaster Teaches:
- How to read notes on the treble and bass musical staffs.
- The names of the notes.
- Where the notes are on the keyboard.
- How to play whole notes, half notes, quarter notes, eighth notes and sixteenth notes in combinations, in both 3/4 and 4/4 time.
- How to play in different tempos.

RhythmMaster Requires:
- Commodore 64 or Commodore 128 with disk drive.
- Melodian Musical Keyboard kb-01 is required to study the reading and playing of musical notes. However, RhythmMaster can be used without the Melodian Musical Keyboard to study rhythm, by playing the notes on the computer keyboard.

Programmer's Tool Kit
pt-01

$29.95

Contains programs, and BASIC source listings for reading the Melodian Musical Keyboard, and for reading and creating music files for Melodian ConcertMaster.

ConcertMaster Software
cm-01

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ConcertMaster teaches how a composition is put together, note by note, instrument by instrument. You learn to play 35 pre-recorded songs from Bach to Rock. Then you can compose your own songs and record them right onto your floppy disk.

ConcertMaster Teaches:
- Scales
- Bass lines
- Familiar Beginner Songs such as "Jingle Bells"
- Easy classical songs such as "Bach Minuet" and Ravel's "Bolero"
- Advanced classics like "A Midsummer's Night Dream" by Mendelssohn
- Popular hits such as "Thriller"

Instruments Sounds
Organ, Trumpet, Flute, Clarinet, Piano, Harpsicord, Violin, Cello, Bass, Banjo, Mandolin, Calliope, Concertina, Bagpipe, Synthesizer 1, Synthesizer 2, Clavier 1, Clavier 2, which can be played over a 7 octave range. Programmable sounds as well.

Recording Functions:
Three track sequencer (recorder) with overdubbing and multitimbral (different instrument sounds at the same time) effects.
Each track can be set to one of seven different functions:
- **Monitor:** Lets you use a track to play music live, without recording it.
- **Record:** Records a track as you play.
- **Playback:** Lets you hear whatever has been recorded or loaded into the track. You may playback one track while recording another to build layers of instruments.
- **Mute:** Turns a track off. This is useful when you want to listen to or record one or two tracks at a time.
- **Save:** Stores a track to the disk.
- **Load:** Loads a track from the disk.
- **Protect:** Write protects a track.

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- Choose from pulse, sawtooth, triangle and noise sound sources.
- Control the sound envelope with attack, decay, sustain, and release times.
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- Set Low pass, band pass, and high pass filter frequencies.

ConcertMaster Requires:
- Commodore 64 or Commodore 128 with disk drive.
- Melodian Musical Keyboard kb-01 is required to study the reading and playing of musical notes. However, ConcertMaster can be used without the Melodian Musical Keyboard to playback the recorded musical examlpes, record music played on the computer keyboard, and to create new instrument sounds.

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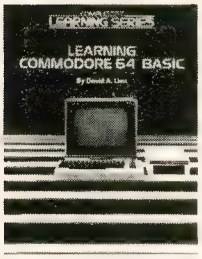

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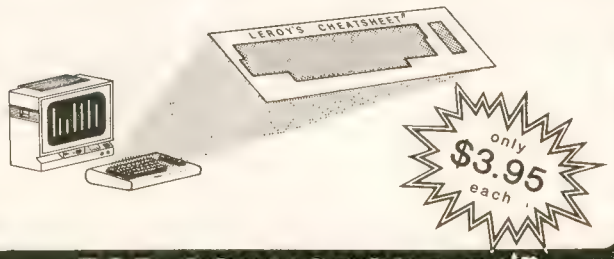

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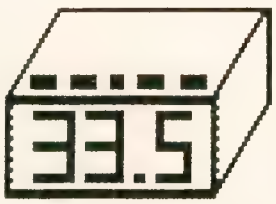

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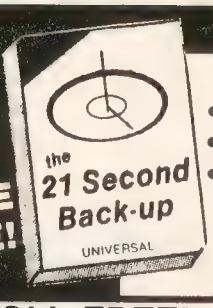

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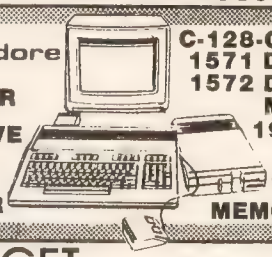

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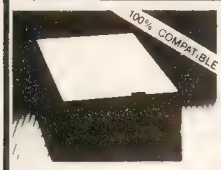

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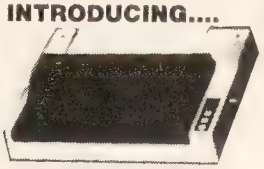

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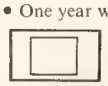 Regular $49 95

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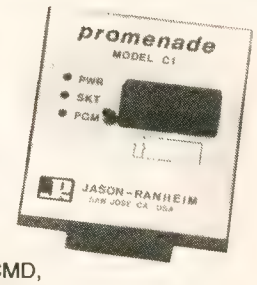

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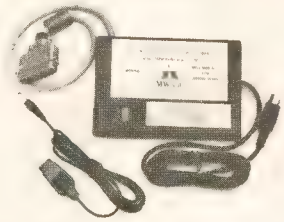

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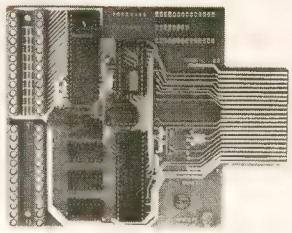

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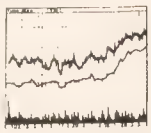

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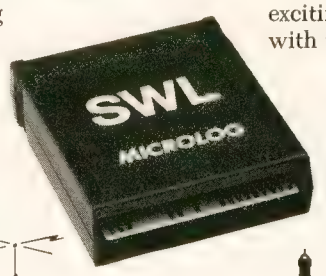

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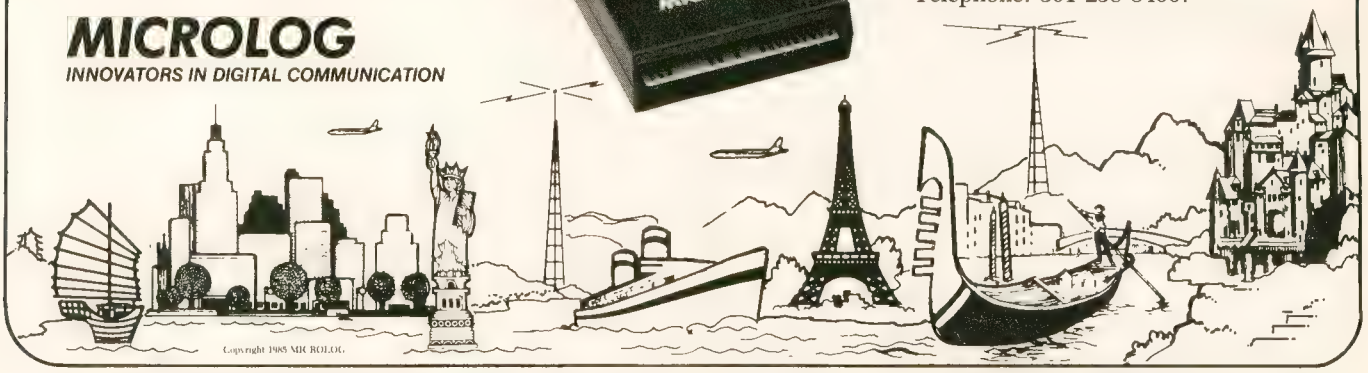

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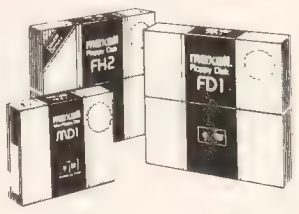

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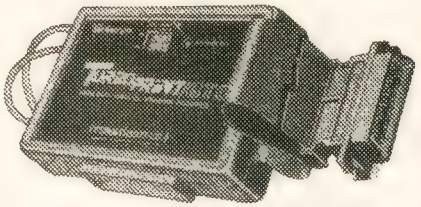

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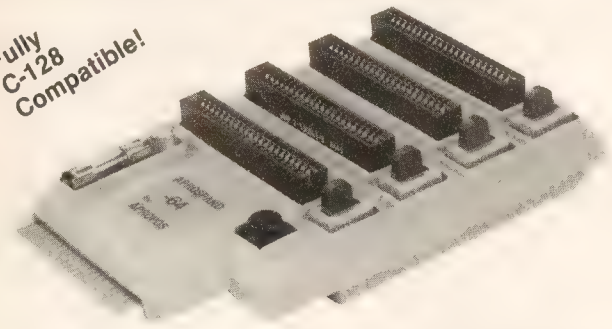

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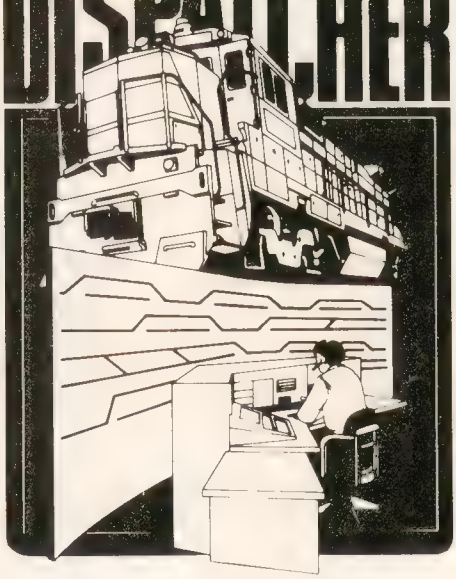

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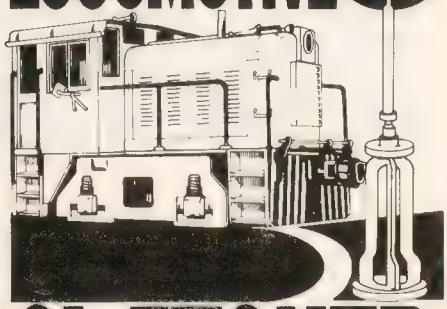

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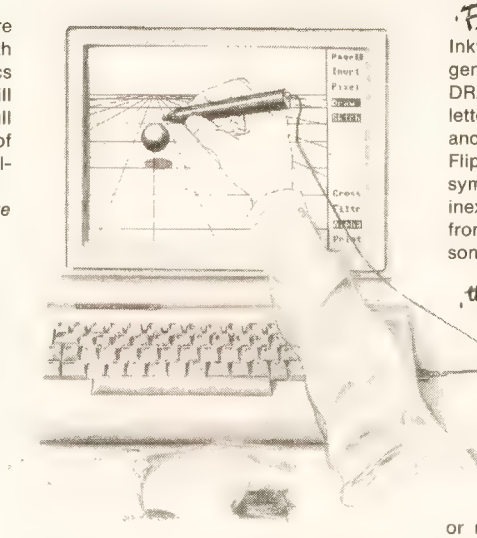

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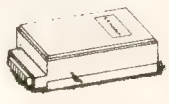

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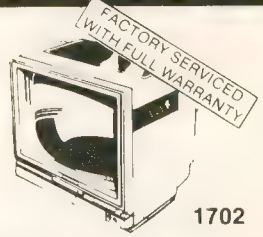

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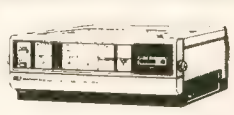

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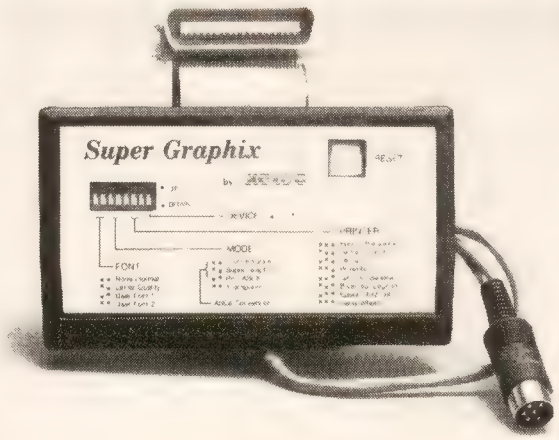

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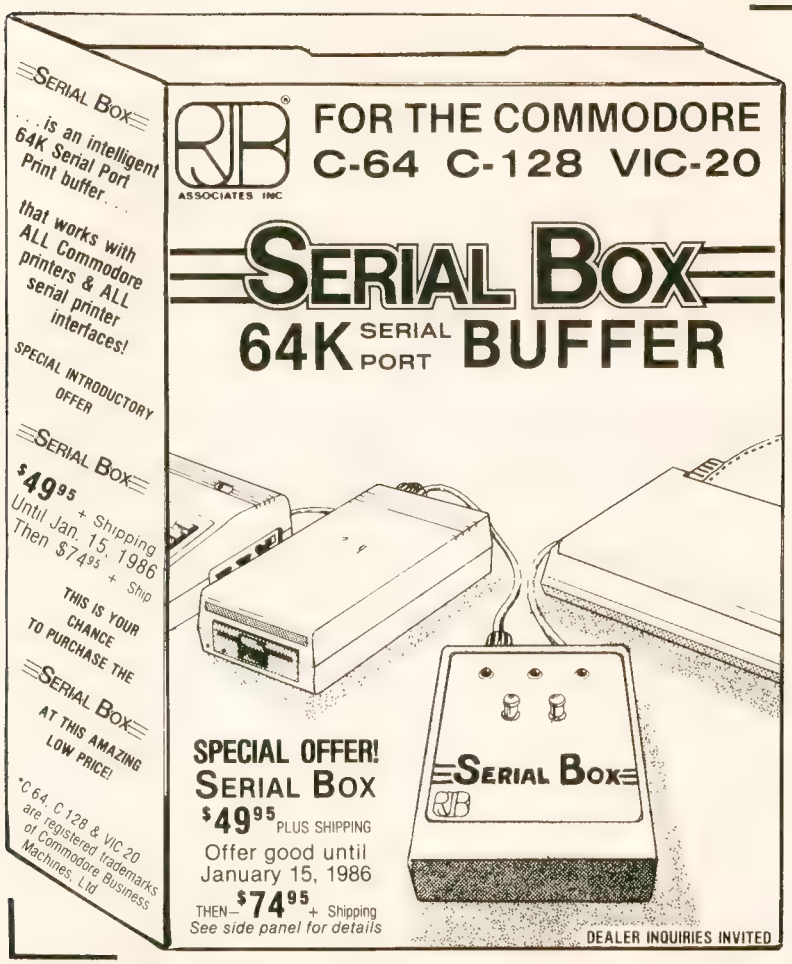
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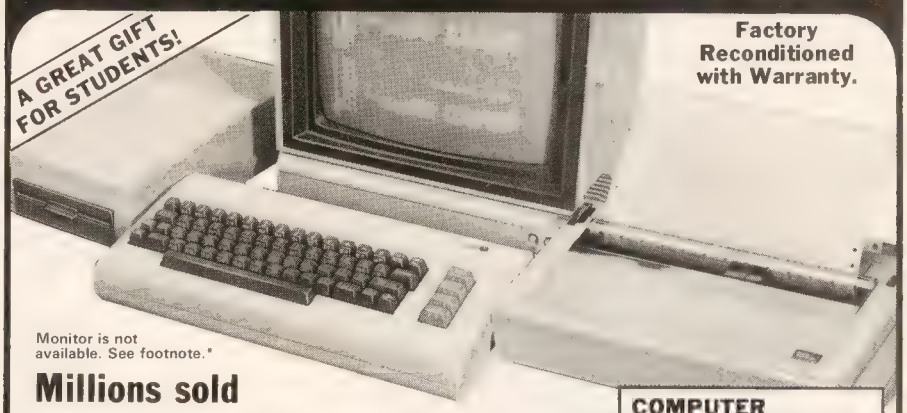

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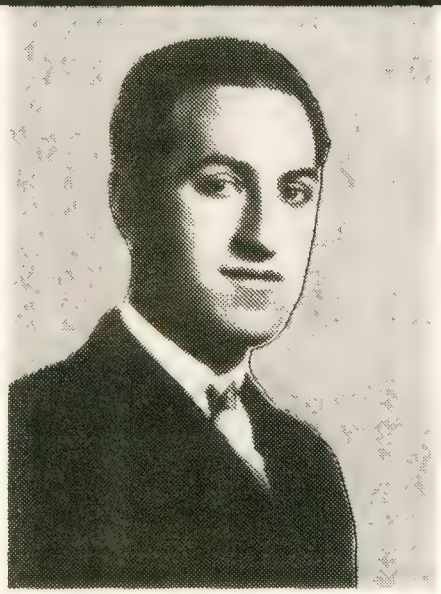

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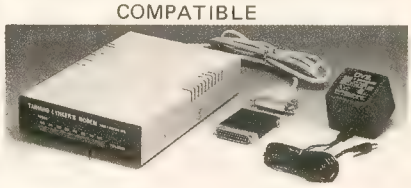

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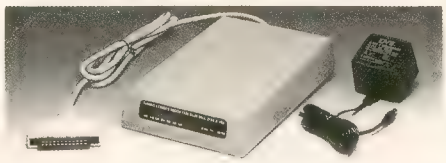

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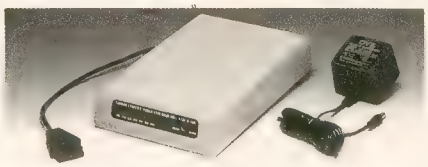

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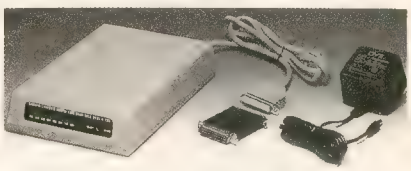

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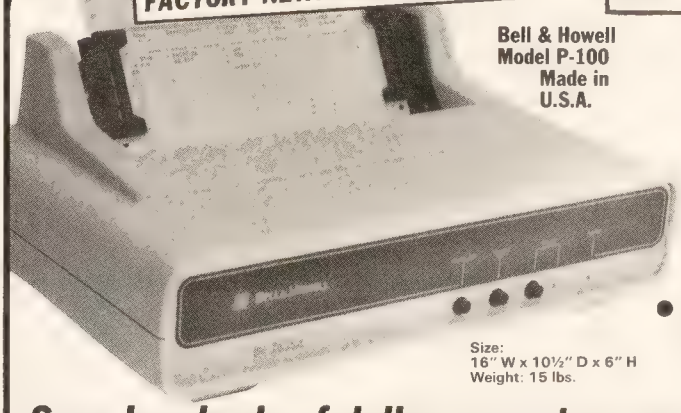

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PAPER SLEW (ADVANCE): 10 lines per second, stepper motor controlled. User selectable pressure roller or tractor feed.

DATA INPUT: Parallel. Centronics type 7-bit ASCII. TTL level with STROBE. ACKNOWLEDGE returned to indicate data was received. **SERIAL:** RS232C. With BUSY handshake. 10 or 11 bits: 110, 150, 300, 1200 Baud. **INPUT POWER:** 115 volts.

PRINT RATE: 100 characters/second. Data Buffer: 1K (Optional expandable to 2K).

OPERATIONAL CONTROLS: Power on/off, set top of form, select/deselect, line/forms, feed

MEDIA: Roll paper: 8½"W x 5" dia. single ply or pressure sensitive multiple copy paper. .012" max. thickness. Fan fold paper: 1" to 9½" sprocket (including sprocket margins). .012" max. thickness.

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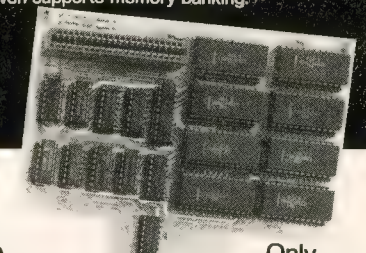

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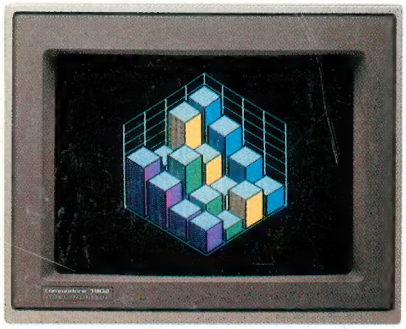

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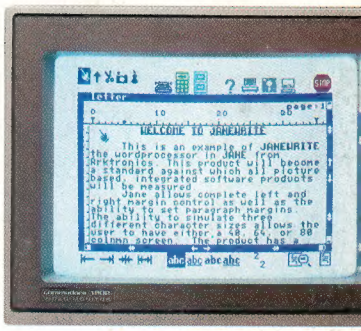

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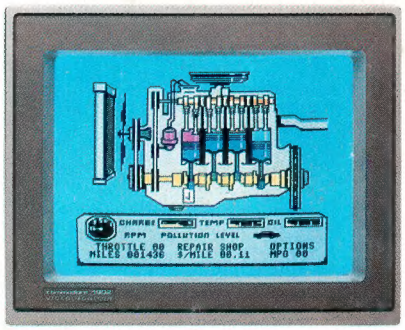

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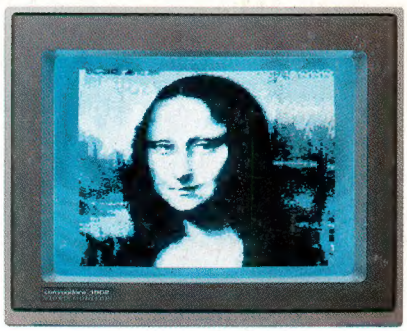

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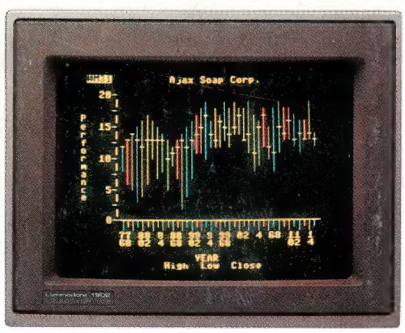

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